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No. 9



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BIOCHEMISTRY

UDC: 615.33.012.6.002.5

IMPROVED ASSEMBLY LAYOUT IN EQUIPMENT USED IN THE MICROBIOLOGICAL INDUSTRY

Moscow ANTIBIOTIKI in Russian Vol 26, No 1, Jan 81 (submitted 17 Jul 80) pp 10-15

[Article by V. Ye. Matveyev, G. Ye. Skvortsov and A. V. Eyromdzhants, Main Administration of the Microbiological Industry under the USSR Council of Ministers, Moscow]

[Text] It is a known fact that high reliability and effective operation of equipment assembly layouts [diagrams] (EAL) play a role in assuring aseptic conditions in processes of recovering pure cultures of microorganisms on the basis of experience gained in microbiological laboratories and production. A mandatory condition is guaranteed possibility of sterilizing all elements of the EAL without exception.

In our previously published works [1, 2], we discussed some of the distinctive features in assembly of pipe connections in technological systems for microbiological production and described the results of experimental studies of sterilization with live steam of the most common elements of EAL. As a result of these studies, we determined the typical units [assemblies] which cannot be sterilized under certain conditions. Each of these units (Figure 1) is a standard representative of a specific group of EAL elements with regard to distinctive features.

Unit I consists of open pipe ends: samplers, culture-loading nozzles, spent air lines and other analogous units, within the recesses of which sterilization temperature does not exceed 100°C, regardless of the diameter of the pipelines.

Unit II consists of heat seals of the pipelines, in the "dead-end" recess of which the temperature reaches 120°C when the nominal diameter is less than 40 mm (valves 1 and 4).

Unit III consists of the segment of air delivery lines (pipe from the equipment to valve 1), in the dead-end recesses of which the temperature also reaches 120°C when the nominal diameter of the pipes and fittings is less than 40 mm.

On the basis of our previous studies [2], we determined the actual values of sterilization criteria [3, 4] in order to make a quantitative evaluation of the effectiveness of sterilization modes in the "weak" points of the standard units. We proceeded from the condition that there was maximum contamination of internal recesses of standard EAL units, which occurs when there is a remainder in them of the various liquids with high concentration of microorganisms that were passed

through them. The required values of sterilization criteria were calculated from the indicator of aseptic effectiveness [5]:

$$\Delta_{\text{rv}} = \ln \frac{X_0 V_p}{S_{\text{ac}}} \quad (1)$$

where Δ_{rv} is the required value for the sterilization criterion, X_0 is the concentration of microorganisms in the remaining liquid prior to heat sterilization, cells/ml, V_p is the volume of remaining liquid subject to heat sterilization, ml, and S_{ac} is the indicator of aseptic effectiveness.

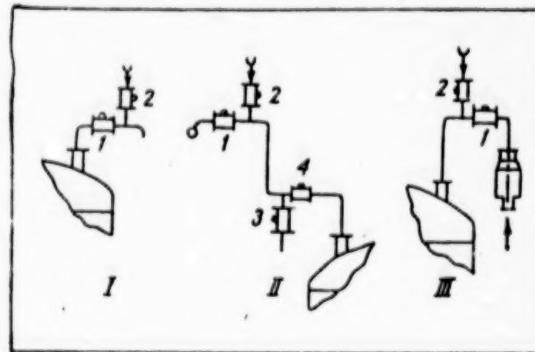


Figure 1.

Standard units of EAL

- I) open pipe end
- II) heat seal
- III) section of air delivery line
- 1,2,3,4) valves

culture in the pipe was considered to be 50 ml. Under these conditions, the required sterilization criterion constituted 30.59.

Actual values of sterilization criteria at "weak" points of standard units

Unit type	Nominal pipe diameter, mm	Temperature check points (see Figure 1)	Sterilization temperature, °C	Actual sterilization criterion
I	15	Valve 1	69	0
		Pipeline	97	0.013
	100	Valve 1	99	0.013
		Pipeline	100	0.793
II	15	Valves 1 and 4	90	0.013
		Pipeline	139	5912
	40	Valves 1 and 4	121	120
		Pipeline	141	7503
III	15	Valve 1	90	0.013
		Pipeline	138	4700
	40	Valve 1	122	160
		Pipeline	140	6648

A comparison of actual values for the sterilization criterion to the required value shows that there are "weak" points in unit I for pipes of all nominal diameters,

in units II and III for pipes with nominal diameter of less than 30 mm, in which the required efficacy of sterilization is not achieved.

The actual sterilization criteria for weak points in units II and III with nominal pipe diameter of 40 mm are higher than the required criterion of sterilization. However, in view of the fact that the units may contain some mechanical inclusions or solid residue of the culture suspension, which heat much more slowly, the values of this criterion will not be adequate [6]. It is also known that the temperature is 10°C lower under a film of dirt up to 1 mm in thickness than inside the pipe [7]. Considering these restrictions, the sterilization criterion is found to be lower than required, constituting 12.5.

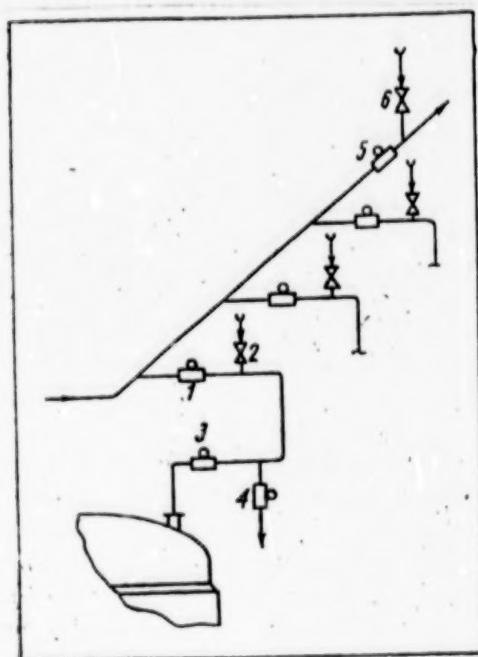


Figure 2.

Diagram of equipment connection with the collector placed at the top
1, 3) valves on the material line
2, 6) steam delivery valves
4, 5) condensate removing valves

To upgrade the units, the sterilization criterion, calculated according to the existing mode [2] (heating from 100°C to sterilization temperature within 10 min and maintaining this level for 60 min), constitutes 5791, and it is the same for all points, being considerably higher than the required value. Evidently, with such a high sterilization criterion, one can lower the sterilization temperature or reduce time of exposure to it in such units. For this purpose, we calculated a new mode of sterilization for the updated units with an indicator of sterilization efficacy of 0.001. We took into consideration the fact that, when heating the interior of units to a temperature of 139°C for 10 min, the temperature underneath a layer of dirt up to 1 mm in thickness will be of the order of 129°C, while the criterion of sterilization through the heating process will be 19.8 at this point. For this reason, to provide the required sterilization criterion, i.e., 30.59,

In order to assure sterilization and equal efficacy thereof at all points within units II and III, we proposed to move the points of steam delivery and removal of steam and condensate mixture from the material [carrying?] pipeline into the housing of valves 1 and 4. Our intention was to deliver steam directly into valve 1 with removal of condensate either into the apparatus to which the line to be sterilized is connected, or the line of "dirty" condensate through valve 3.

In order to assess the sterilizability of the updated units, we studied the temperature changes as a function of time inside valve 1. We used a pipe with nominal diameter of 15 mm as being the one that heats the most poorly. As a result, it was established that the temperature at all points of the heat seals reached the same level, and heating time to the maximum temperature of 139°C constituted less than 10 min.

exposure at a temperature of 129°C should last about 1 min for surfaces that are covered with a layer of dirt. Moreover, because of the rapid drop of steam pressure and temperature after sterilization, the criterion of sterilization of the cooling process is considered to be zero. Under such conditions, the overall sterilization criterion will constitute 214.5.

Thus, one can recommend the following mode of sterilization for updated standard units II and III: heating for 10 min to a temperature of 139°C, maintaining this temperature for 1 min followed by rapid cooling. The 59-min reduction of sterilization time in the recommended mode is indicative of the significant increase in its economy.

The experimental data on temperature fields, obtained for the three standard units, which are widely used in equipment for technological processes in the most diverse types of microbiological synthesis, enables us to offer several comments and recommendations, not only for further refinement of sterilization modes, but the design of EAL.

The existing EAL's, which operate under aseptic conditions, have several typical features from the standpoint of design and spatial arrangement of elements of communicating apparatus. They have a significant influence on reliability and efficiency of operation of such systems, their ergonomic and operating parameters, as well as sanitary and hygienic conditions in industrial premises.

In the vast majority of cases, when organizing delivery and removal of flow of various technological media (nutrient medium, culture fluid, various supplements, aerating air, steam, etc.), a group of apparatuses is connected simultaneously to several collectors. As a rule, each collector is higher than the connecting nozzles of the apparatus (Figure 2) and connected to them by means of heat seals [gates?] (valves 1, 2, 3 and 4). The collector ends with valve 5, which is connected to the line of "dirty" condensate with delivery of steam to it through valve 6. The collectors are sterilized by delivering steam and removing condensate through the heat seals, the pipelines of which are quite long. Each collector is sterilized as many times as there are operations to transfer material to other equipment connected to this collector per cycle of fermentation in one piece of equipment.

Finally, EAL's are characterized by the presence of many dispersed pipes, fittings, places where couplings are sealed, etc. The probability of unsealing of assembly layouts and equipment is quite high, since defective seals are demonstrable in about three out of five technological cycles [8, 9].

The above distinctions of existing layouts inevitably generate certain technological and design flaws. Thus, when the collector is placed at the top and it is sterilized with steam through the pipe of the heat seal, the first batches of cold unsterile condensate accumulate in the recess of valve 3, which separates the sterile space in the apparatus from the heat seal. For this reason, with the rather high probability of impaired sealing of this valve, there may be contamination by extraneous microflora of the contents of the apparatus. There is a similar danger of contamination by the "dirty" condensate line, in which there is usually condensate that is contaminated with extraneous microflora. For this reason, when the seal of valves 4 and 5, which separate the sterile interior of the material-delivering pipe from the "dirty" condensate line, is impaired, extraneous microflora could penetrate into the material being transferred in the

collector. Among other flaws, we should mention the high expenditure of steam, considerable loss and emission of heat into the environment of production premises due to the significant length of the heat seal pipes. Moreover, the high location of collectors and fittings, dispersion of control and service places make it necessary to take additional steps with regard to safety practices, development of metal-containing special service areas, ladders [stairs], passageways, etc., which leads to more time-consuming operations and drop of ergonomic parameters of EAL.

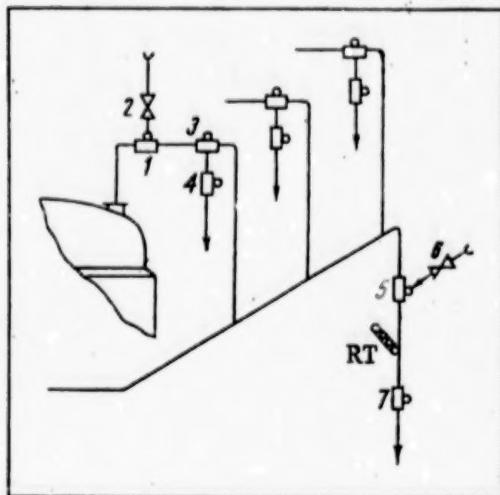


Figure 3.

Diagram of equipment connections with collector located at the bottom

- 1, 3) valves in material-supplying line
- 2, 6) steam delivering valves
- 4, 5, 7) condensate removing valves
- RT) resistance thermometer

penetration of extraneous microflora from dirty condensate through valve 5. For this reason, the required steam pressure and temperature are maintained in the formed heat seal, and in the event of impairment of the seal of valve 5, only insignificant amounts of steam will get into the collector as well, instead of the dirty condensate. A resistance thermometer can be installed in the heat seal between valves 5 and 7 to monitor sterilization temperature.

The collector is sterilized by delivering steam to the heat seals through valve 2, with valves 3 and valve 5 open, removing condensate through valve 7. After sterilization, valve 5 is shut, and a heat seal is created beyond it. The resistance thermometer is beyond valve 5 to rule out the influence of possible impairment of the seal of the packing element.

The heat seal is designed to prevent penetration of extraneous microflora through the fitting if the seal is broken by means of creating a high-temperature steam "plug." It will play the same role, when the length of its pipeline is reduced to a minimum. This design makes it possible to concentrate the heat seal valves in a circumscribed region in the immediate vicinity of the apparatus, and thereby raise drastically the ergonomic and operating parameters of the assembly layout, as well as improve substantially the sanitary and hygienic conditions in production areas by reducing heat emission into the environment.

The influence of these flaws of EAL on sterility of material being transferred or located in the equipment can be eliminated or minimized by developing new technological versions, the essence of which is illustrated in Figure 3.

Placing the collector below the nozzle of the connected apparatus prevents condensate from the heat seal from penetrating into the equipment. During sterilization of the collector, as well as operation of the heat seal in the technological mode, steam is delivered into valve 1, which separates the sterile interior of the apparatus from the heat seal, and the condensate is removed through the collector or valve 4. If the seal of valve 1 is broken, a negligible amount of steam will get into the apparatus, rather than "dirty" condensate.

An additional valve 7 was installed in order to rule out the possibility of

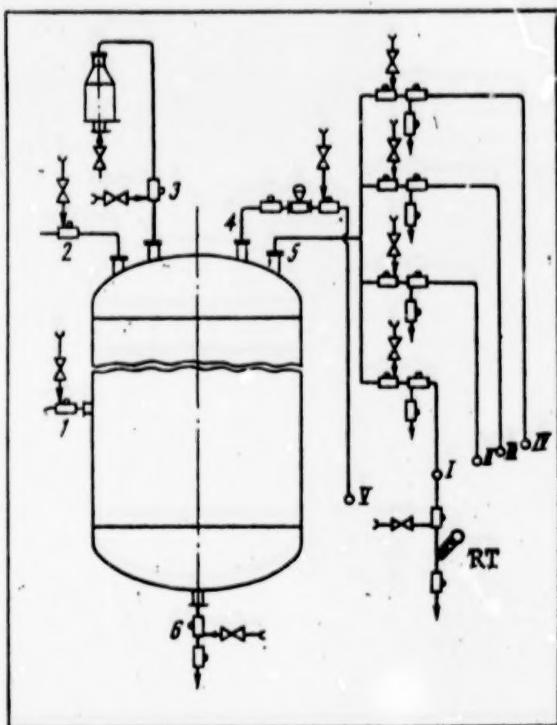


Figure 4.
Improved EAL

- 1) sampler
- 2) delivery of culture material
- 3) delivery of air
- 4) delivery of foam suppressor
- 5) connection of collector device
- 6) bottom outlet
- I) channeling collector
- II) loading collector
- III) product dispensing collector
- IV) supplement delivering collector
- V) foam suppressor delivering collector
- RT) resistance thermometer

Figure 4 illustrates the EAL which was developed with consideration of the recommendations submitted here and in [1, 2].

Thus, elimination of the "weak" points in the new EAL's, reduction of size of heat seal pipes, placement of collectors and fittings in an area that is convenient for servicing, monitoring the temperature in weak points and validation of economical modes of sterilization on the basis of the sterilization efficacy parameter make it possible to guarantee sterility of the EAL, with significant reduction of time and expenditure of steam for sterilization, as well as to raise the ergonomic and operating parameters of assembly layouts, to improve sanitary and hygienic conditions in production areas and ultimately improve substantially the productivity of labor and quality of the product. The expected economic effect of adopting the recommendations to upgrade sterilization modes and arrangement of EAL's as they apply to an industrial shop with 10 fermenters with 63 m^3 capacity is in excess of 1 million rubles.

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BIOCHEMICAL NATURE OF THE COMPLEMENT FIXING ANTIGEN OF ARENAVIRUSES

Moscow VOPROSY VIRUSOLOGII in Russian No 2, Mar-Apr 80
(manuscript received 25 Oct 79) pp 228-232

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[Text] At the present time, the arenavirus group includes 11 representatives, united on the basis of morphology and antigenic relationships—characteristic of these viruses only—which are manifested in various serological reactions. With the help of a neutralization reaction it is possible to differentiate even the viruses of the Tacaribe complex which (based on complement fixation (CFT) and fluorescent antibody (FAT) tests) are closely related. As a rule, for complement fixing (CF) antigens, we used only crudely purified virus-containing preparations inactivated, as needed, with β -propiolactone, formalin or chloroform. There are data in the literature on the presence in such suspensions of arenaviruses of two different antigenic components. One of these is present in the form of the so-called soluble antigen (SA) and can be separated from the virions by one or another means. The nature and properties of this antigen have, as yet, received little study up to the present time.

Until recently, a detailed study of SA of arenaviruses has been conducted only in lysates of cells infected with the Pichinde virus (2). The currently accepted theory is that SA, which can be separated from the virus by centrifugation is itself a degradation product of the structural proteins.

It is also unclear what part CF-SA plays in the serological manifestations of the arenaviruses. It has been found, only for the LCM virus, that the virion and SA possess distinct antigenic properties (3). Thus, in animals, SA elicits the formation of antibodies which are not capable of neutralizing infectious activity and which do not provide protection from repeat infection of immunized guinea pigs by the virus. These data suggest that the virus coat does not contain SA.

The present article is concerned with clarification of the biochemical nature of SA isolated from a suspension of brain cells of white mice inoculated with

arenaviruses and determination of the role of SA in the immunological correlations between members of the arenavirus group.

Materials and Methods

Viruses. We utilized the following arenavirus strains: LCM strain CA 1371; Tacaribe--TR 11573; Amapari--AN 70563; Tamiami--CDCW 10777. All strains were maintained in the laboratory by serial passage in suckling, mongrel white mice, in the brain. Age of sucklings at infection was 2-3 days. On the 8th day after inoculation, brain was removed from the infected mice and, for future work, a 20% suspension in physiological solution was prepared.

In addition to the viruses listed, we used a suspension of brain cells inoculated with the viruses Machupo strain C-80/81 and Junin strain HJ 15950 inactivated in formalin to prepare CF-SA.

Immune ascitic fluid was obtained from adult white mice immunized with the above mentioned viruses.

Determination of infectivity of arenaviruses. We used platelets in a culture of cells of the intermixed VERO line. The virus titer was expressed in platelet circulating units per 1 ml.

Preliminary processing of the virus-containing suspension. The virus-containing brain cell suspension was treated with ultrasound (6 times for 30 sec in the range of 22 kHz) using the sonicator UZDN-1. The suspension was then centrifuged at 15,000-18,000 rev/min for a period of 20 minutes in a K-24 centrifuge (GDR) and the supernatant was used for gel chromatography. In certain cases, for additional concentration of antigens, we froze the supernatant at -80°C and then, in that state, recentrifuged the sample at the same speed for 30-50 min. For gel chromatography, we used the concentrate formed during centrifugation.

Isolation of SA was accomplished by gel filtration in the servachromium A-2 ("Serva", FRG). We used a column with dimensions of 50 x 2.7 and 30 x 1 cm. For the eluting buffer, we used 0.05 M tris-HCl-buffer (pH 7.6-7.8) which contained 0.1 M sodium chloride. This buffer was used subsequently for all studies of SA. Fractions in which CF activity was detected were combined and when necessary, concentrated in the instruments MMS, MMSA ("Amicon", USA) with UM-10 and PM-30 ultra-filters. In certain cases, concentration was accomplished with the aid of polyethyleneglycol (PEG) with a mol. wt. of 20,000 ("Serva", FRG) by placing dry PEG in the dialysis bag with the sample.

Gel filtration on Sephadex G-200 was performed on a 30 x 1 cm column. Blue dextran ("Pharmacia", Sweden) was used to calibrate the column for the void volume, and a low molecular weight stain was used for the retained volume.

The protein concentration was determined by Lowry's method (4) and spectrophotometrically by absorption at 280 nm.

Serological investigation. A standard micromethod of CFT was used. The agar gel diffusion precipitation test (AGDP) was conducted on slides covered with 1 percent

Difko agar. Diffusion of antigens and sera occurred for 18 hours in a wet chamber at 37°C.

Determination of buoyant density. The samples were layered on a preliminarily-formed linear cesium chloride ("Merk", FRG) gradient with a concentration of 25-45 percent and centrifuged in an SW-50.1 rotor in an L5-65 ultracentrifuge ("beckman", USA) at 45,000 rev/min for 22 hours at 4°C. Measurements of the sedimentation coefficients of the centrifuged samples were performed in a 10-30 percent sucrose gradient at 15°C for 3.5 hours at 40,000 rev/min in an SW-40 rotor in an L5-50 ultracentrifuge ("Beckman", USA). As markers we selected 60S and 40S ribosomes.

Treatment of SA with Triton X-100. We used a solution of Triton with a final concentration of 2 percent ("Serva", FRG) in 1 M sodium chloride. The samples were exposed to Triton for 30 min at 37°C.

Analysis of SA-RNase A. RNase A ("Serva", FRG) was used in concentration of 150 µg/ml at 37°C for 1 hour.

Results and Discussion

The results of preliminary treatment (sonication and centrifugation) showed that the virus-containing suspensions contained 15-20 mg/ml of protein, had titers in CFT of 1:32-1:128 and in AGDP--1:2. After additional concentration, the protein content of the suspension increased to 30-70 mg/ml and the activity in CFT and AGDP was increased to 1:512 and 1:16 respectively.

For quantitative separation, from these suspensions, of SA not fixed to virion particles, we found it necessary to select a method which satisfied a number of conditions: 1--the use of denaturing procedures was ruled out and 2--the virion particles and SA had to be obtained in a form which could allow quantitative evaluation and comparison of their antigenic activity.

The method which satisfied the above listed requirements was gel filtration of the brain cell suspension in servachromium A-2. A typical elution profile of the Tamiami virus is shown in fig 1a. Analogous profiles were obtained for all arenavirus suspensions studied. Thus, as is evident from fig 1a, practically all CF-antigenic activity of the suspensions analyzed was detected in the zone adjacent to the retained volume of the column (second protein peak in fig 1a), and was completely separated from the virus particle which, by virtue of its own substantial dimensions (50-300 nm) and large molecular weight (1.5×10^8) (5), must be eluted in the void volume on the column in the zone of the first protein peak. Peak CF activity also eluted with soluble antigen. Based on data from gel chromatography on servachromium A-2m, the molecular weight of SA amounts to approximately several hundred thousand daltons.

In certain cases, for rapid extraction of a moderate amount of SA, we utilized a column of smaller dimensions. The profile for the Amapari virus is shown in fig 1b. Use of this type of column shortened the time of chromatography to 3-4 hours.

To determine the degree of distribution of infectivity of the Amapari virus plaques in fractions Nos 1, 4, 6, 8 and 10 (see fig 1b), we used plaques in a culture of VERO cells. The virus titer in the initial brain cell suspension was 5.5 lg BOYe [expansion unknown] /ml, in fraction Nos 1 and 4-4.5 and 3.9 lg BOYe/ml respectively and, in the remaining fractions, it was not possible to detect the virus by the plaque method. Thus, in fractions corresponding to the outflow of SA, the infectious virus was not detected.

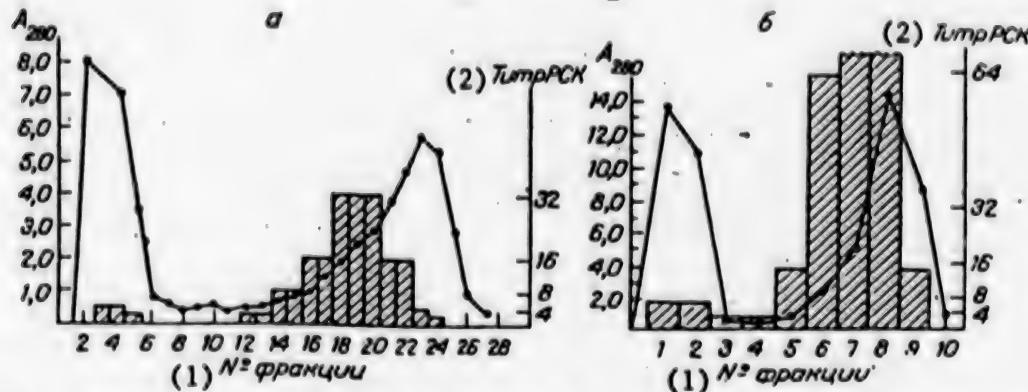


Рис. 1. Гель-хроматограммы антигенных препаратов ча сервахроме А-2.

а—вирус Тамиами. Колонка 50×2,7 см. Объем образца 30 мл. Объем фракции 12 мл. Фракции отбирались с 90 мл; б—концентрированный препарат вируса Амапари. Колонка 30×1 см. Объем образца 3 мл. Объем фракции 3 мл. Фракции отбирались с 10 мл. Здесь и на рис. 2—4 заштрихованы значения титров РСК.

Fig 1. Gel Chromatograms of Antigen Suspensions on Servachromium A-2
 a--Tamiami virus. 50 x 2.7 cm column. Sample volume 30 ml.
 Fraction volume 12 ml. Fraction removed with 90 ml; b--concentrated suspension of Amapari virus. 30 x 1 cm column. Sample volume 3 ml. Fraction volume 3 ml. Fraction removed with 10 ml. Here and in figs 2-4, shaded areas signify CFT titers.

Key:

1. Fraction number
2. CFT titer

The isolation of SA of six arenaviruses was studied for crossreactivity by CFT and AGDP. The results are shown in tables 1 and 2. As is evident from these tables, the degree of antigen correlation was shown to be identical to that found in a study using brain cell antigens prepared according to standard methods (6, 7).

Таблица 1

Перекрестные реакции между аренавирусами при исследовании РА в РСК

(2) Антиген	(1) Сыворотка					
	(3) Амапари	(4) Таскарибе	(5) Мачуло	(6) Хунин	(7) Тамиами	(8) ЛХМ
Амапари (3)	256/16	128/16	64/16	32/32	16/8	0/0
(4) Таскарибе	32/16	128/64	16/32	16/64	0/0	0/0
Мачуло (5)	32/32	32/32	64/64	64/32	0/0	0/0
(6) Хунин	32/32	32/64	64/64	64/128	0/0	0/0
Тамиами (7)	8/4	4/4	0/0	0/0	128/128	0/0
(8) ЛХМ	0/0	0/0	0/0	0/0	0/0	64/64

(2) Примечание. В числителе—титр антигена; в знаменателе—титр сыворотки (обратные величины).

Table 1. Crossreactivity Tests among Arenaviruses in Studies of SA in CFT

Key:

1. Serum
2. Antibody
3. Amapari
4. Tacaribe
5. Machupo
6. Junin
7. Tamiami
8. LCM
9. Note. In the numerator--antigen titer;
in the denominator--serum titer (inverse values)

Таблица 2
Перекрестные реакции между аренавирусами
при исследовании РА в РДПА

(1) Антител 1:2	(2) Сыворотка					
	(3) Амапари	(4) Такарibe	(5) Мачуло	(6) Хунин	(7) Тамиами	(8) ЛХМ
Амапари (3)	16	0	н/р	0	0	0
(4) Такарibe	2	16	8	0	0	0
Мачуло (5)	4	1	16	0	0	0
(6) Хунин	4	1	8	8	0	0
Тамиами (7)	0	0	0	0	8	0
(8) ЛХМ	0	0	0	0	0	16

(9) Примечание. Представлены обратные величины титров сыворотки.

Table 2. Crossreactivity among Arenaviruses in Studies of SA in AGDP

Key:

- | | |
|----------------|-----------------------------------|
| 1. Antigen 1:2 | 6. Junin |
| 2. Serum | 7. Tamiami |
| 3. Amapari | 8. LCM |
| 4. Tacaribe | 9. Note. Inverse values for serum |
| 5. Machupo | titers are shown |

To establish the biochemical nature of SA obtained, we measured buoyant density in cesium chloride, sensitivity to RNase A (using the Tamiami virus) and the sedimentation coefficient on a saccharose gradient (using the Tamiami, Tacaribe and Amapari viruses).

To measure the buoyant density of the concentrated SA of the Tamiami virus, we layered the sample on a cesium chloride gradient and centrifuged it to equilibrium. Analogous tests were conducted on SA samples treated with RNase A.

Results are presented in fig 2a and b which show that SA forms a fairly wide peak of a gradient density ($\rho = 1.33-1.31 \text{ g/cm}^3$, with a mean of 1.31 g/cm^3). After RNase treatment the density of SA fell significantly to $1.31-1.27 \text{ g/cm}^3$ (with a mean of 1.29 g/cm^3). As a result of its complex structure and isolation from brain cell suspensions, SA was subject to contamination by nonspecific absorption of substances. Therefore, the significance of buoyant density measurements was decreased. Moreover, the proteins found in the composition of SA can be absorbed nonspecifically by cellular nucleic acids. Considering these limiting factors, we determined the buoyant density of SA after treatment with Triton X-100 according to methods utilized by various authors to separate nucleocapsids of viruses. The buoyant density of the samples treated with Triton was equal to $1.35-1.36 \text{ g/cm}^3$ (fig 2c). This value correlates well with data in the literature defining the buoyant density of the nucleocapsid of the Tamiami virus (8) as 1.36 g/cm^3 .

For identification of the possible connection between protein components of SA and RNA, we studied the effect of RNase A on the chromatographic behavior of SA. Tamiami virus SA was subjected to gel filtration in Sephadex G-200 before and after RNase A treatment. The results are shown in fig 3. The initial SA, to a great extent, was eluted in the zone of the void volume of the column and entered the pores of the gel (fig 3a). The results of gel filtration in servachromium attest to the large molecular weight of SA. After RNase treatment the antigenic activity

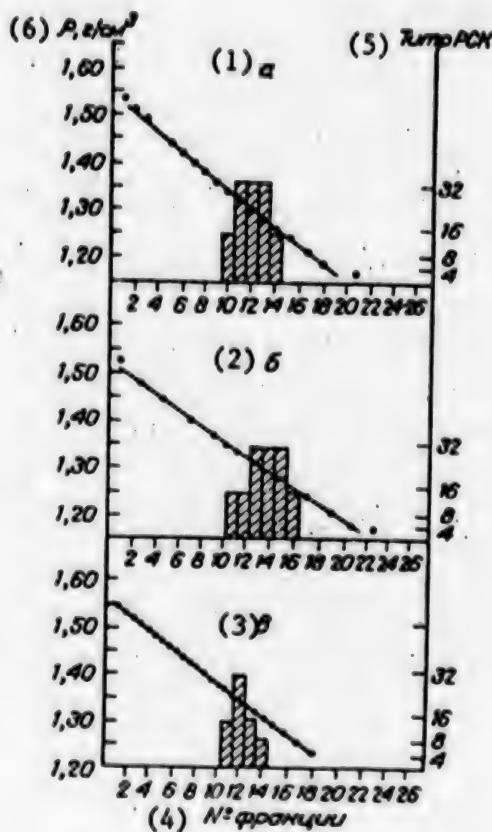


Рис. 2. Равновесное центрифугирование РА вируса Тамиами в градиенте плотности хлорида цезия.
 а — необработанный РА; б — РА, обработанный РНК-азой А; в — РА, обработанный тритоном Х-100.

Fig 2. Equilibrium Centrifugation of SA Derived from the Tamiami Virus in a Cesium Chloride Gradient
 a--crude SA; b--SA, processed with RNase A; c--SA, processed with riton X-100.

Key:

- | | |
|------|-------------------------------|
| 1. a | 4. Fraction number |
| 2. b | 5. CFT titer |
| 3. c | 6. ρ , g/cm ³ |

in CFT shifted markedly to the side of lower molecular weight (fig 3b) underscoring the ribonucleoprotein nature of SA.

We determined the sedimentation coefficient of SA of the Tamiami, Tacaribe and Amapari viruses on a saccharose gradient before and after treatment with RNase. The results obtained corresponded to the behavior of SA in gel filtration. Thus, SA produced a wide peak in a saccharose gradient and had a sedimentation coefficient of 25-30S. Triton did not alter the sedimentation coefficient, but treatment with RNase led to inhibition of antigenic activity at the top of the gradient. The sedimentation properties of SA are represented in fig 4 using the Amapari virus as an example.

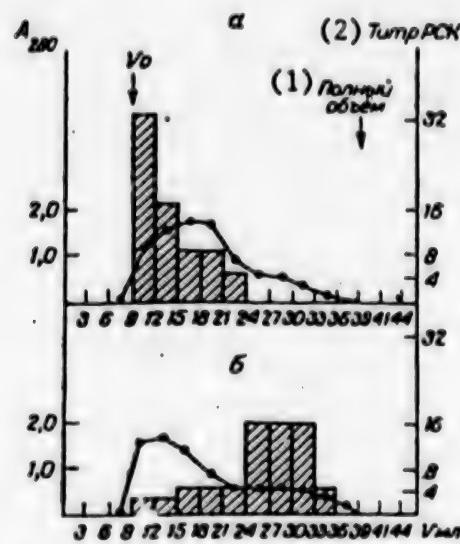


Рис. 3. Гель хроматограмма РА вириуса Таммиами на колонке с сефадексом Г-200.
Колонка 30×1 см. Объем образца 1 мл. а—
небработанный РА; б—РА, обработанный
РНК-азой А.

Fig 3. Gel Chromatogram of Tamiami Virus SA on a Sephadex G-200 Column
30 x 1 cm column. Sample volume 1 ml, a--crude SA; b--SA treated with RNase A.

Key:

1. Retained volume
2. CFT titer

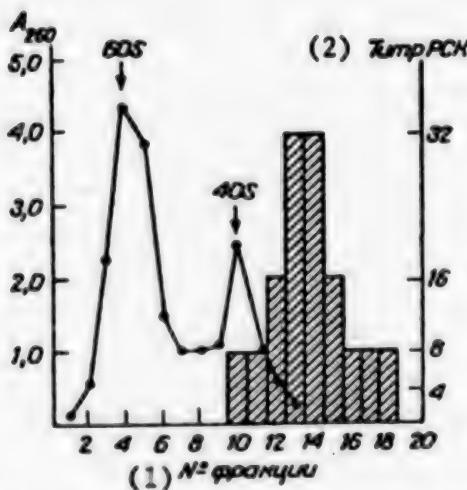


Рис. 4. Седиментационный анализ рас-
творимого антигена вириуса Амапари.

Fig 4. Sedimentation Analysis of Soluble Antigen of the Amapari Virus

Key:

1. Fraction number
2. CFT titer

Data obtained from CFT and AGDP tests show that antigen activity of a suspension of brain cells extracted from new-born white mice inoculated with arenaviruses was entirely determined by the presence in the suspension of the so-called SA. In the process of isolating SA, we noted that the fraction which characterized the highest CF and precipitation activity was isolated from fractions which contained a significant amount of protein material. This finding has great practical significance for developing highly sensitive diagnostic tests, because the presence of a low content of inert protein increases specificity.

Demonstration of its ribonucleoprotein nature and the correspondence between the buoyant density of Tamiami virus SA with the buoyant density of nucleocapsids of the virus suggest that SA is identical to nucleocapsids. Based on the sedimentation coefficient of SA, we can conclude that if SA is produced from nucleocapsids of viruses, then it exists in the form of fragments of the nucleocapsid. Comparison of the sedimentation coefficients for the RNA viruses--31S and 22S (9) and for virions of the Pichinde virus reveals a sedimentation coefficient equal to 320-323S (10). The sedimentation coefficient of all nucleocapsids must be in a range significantly greater than the coefficient of 30S, obtained for SA.

Further definition of the characteristics of SA will require analysis of protein components and correlation with the structural proteins of the virion. This approach is the goal of our future research.

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CSO: 1840/231

BIONICS

UDC: 612.822+612.821.7+612.822.3

ELECTROENCEPHALOGRAPHIC STUDY OF SLEEP OF THE COMMON PORPOISE

Moscow ZHURNAL VYSSHEY NERVOY DEYATEL'NOSTI IMENI I. P. PAVLOVA in Russian Vol 31, No 2, Mar-Apr 81 (manuscript received 1 Apr 80) pp 333-338

MUKHAMEDOV, L. M. and POLYAKOVA, I. G., Laboratory of Evolution of Sensory Systems, Institute of Evolutionary Morphology and Ecology of Animals imeni A. N. Severtsov, USSR Academy of Sciences, Moscow

[Abstract] Since only bottlenosed dolphins (*Tursiops truncatus*) had been submitted to electrophysiological studies of their sleep, showing some differences from terrestrial mammals, the question arose as to whether these differences were present exclusively in this species, or in some other groups of mammals that sleep in water. Three male porpoises (*Phocoena phocoena*) were studied; they had been caught 2-3 months before the experiments and during work with them they were kept separately in a 5x5 tank 1.2 m deep, with prior adaptation to it for 1-2 months. Electrocorticograms of different cortical fields and electromyograms of cervical muscles were recorded using implanted electrodes, which were connected to the electroencephalograph by AVK-6 vibration-proof cables, which did not hamper the free movement of porpoises. In all, tracings on complex polygrams were made for 202 h. (including evoked potentials in response to sensory stimuli). The main synchronization and desynchronization patterns of the electrocorticograms were similar to those of the bottlenosed dolphin and other mammals, showing the same stages as in the dolphin. REM could not be identified in the porpoises, nor was it demonstrated in the bottlenosed dolphin. The distinction of delphinid sleep was that it is combined with swimming, although the bottlenosed dolphin appeared often to be suspended near the surface moving only flippers to the extent of holding their position and providing for respiratory excursions. It is concluded that on the example of delphinid sleep, the main function thereof in mammals must be to meet endogenous needs of the brain, rather than to conserve energy through immobility. Figures 3; references 10: 4 Russian, 7 Western.

[255-10,657]

BIOTECHNOLOGY

UPDATE ON WORK DONE AT THE PUSHCHINO BIOLOGICAL RESEARCH CENTER

Moscow SOVETSKAYA ROSSIYA in Russian 19 Apr 81 p 1

[Interview with G. R. Ivanitskiy, corresponding member of the USSR Academy of Sciences, director of the Biological Research Center, USSR Academy of Sciences, by Alexandr Malinov, special correspondent: "To Serve Man"]

[Text] Bio Means Life

From the mysteries of man to the m steries of the oceans. From nuclear problems to space problems. From the study of living matter to ordinary, routine matter. Such is the range presently covered by Soviet science. And, as stressed at the 26th Party Congress, there is mandatory orientation toward the end result for the national economy.

The difficulty and complexity of the problems that are being solved by science today require the concentration of efforts of many teams, and herein also lies the typical distinction of development of modern Soviet science.

We shall acquaint you with some of the achievements of the scientists at the Biological Research Center of the USSR Academy of Sciences in Pushchino, in the suburbs of Moscow.

Construction of the first institute of the future center started 20 years ago, in the spring of 1961. Today, this scientific city has 6 scientific research institutions of the USSR Academy of Sciences, as well as a Special Biological Instrument Building Design Office, which employ 6 academicians, 5 corresponding members of the Academy, 58 doctors and more than 400 candidates of sciences.

It is inherent in people to strive for an ideal, but often nature already possesses it; for example, the best and most efficient principle of organization of matter exists in most cases expressly in living matter. In the broad sense, the task for biologists is to understand and master this principle. Moreover, the study of living matter on any level--molecular, cellular, viral, etc.--is of exceptional value for use in real and specific applied areas.

[Question] You said "on any level." In other words, these "levels" are the main objects of your biological attention?

[Answer] To some extent. Let us consider the protein molecule. There are thousands serving the most diverse purposes. For example, the main "vital task" of an enzyme (protein macromolecule) is to splice, cut and connect different parts of other molecules and groups thereof by means of its active center, like a machine. The study of each type of protein could reveal the most unexpected possibilities of ultimate practical use. For example, to develop biological photographic material containing no silver.

There is a photosensitive protein, rhodopsin, whose color changes depending on the amount of light quanta that fall on it. In living nature, so-called purple bacteriorhodopsin is widespread. And gene engineering makes it possible to modify it to any other light spectra. There is only one step from this to the idea of biological photographic materials.

But first there was enormous research ["science"]. At the initiative of Academician Yu. A. Ovchinnikov, complex studies of bacteriorhodopsin were started in our country a few years ago. Yuriy Anatol'yevich himself, along with his colleagues, identified the sequence of amino acids in rhodopsin. V. P. Skulachev, corresponding member of the USSR Academy of Sciences, studied the mechanism of action of the light quantum at Moscow University. In our Institute of Biophysics, work was also pursued in this field. And when sufficient basic data were accumulated, this practical idea was conceived.

New photosensitive emulsions must have several remarkable properties, for example, the previously unattainable capacity of photographic materials to distinguish between details of only tens of angstroms. It became possible to develop unique biocomputers operating on the principle of technical electronic analogue systems. Finally, these photosensitive emulsions store information, and in addition it can be erased. This means that they can be used in technical systems as memory elements.

Protein is an example of a high molecular compound, one of the components of a cell. The system of organization of the cell is already considerably more complex, I would say, wiser in purpose. For example, one of its parts is the cell membrane. Its task is to allow or not allow substances to pass into the cell, depending on prevailing conditions, for example, metal ions. Such a system can react to the presence of some fragrant substance. Using this principle, selective electrodes are being developed in engineering, for specific types of fragrant substances. Similarly, one can develop, figuratively speaking, an artificial nose. But thus far, these systems cannot be compared in any way to natural ones. An encouraging compromise is being offered: To make the electrical part of the system traditional, i.e., micromodular wires, and to use a membrane with built-in protein receptors that react to odors as the sensing element. Such bioengineering symbioses, with amazing sensitivity, are already being developed.

Viruses and bacteriophages are the next level of organization of life. I would compare the arrangement of some of them to machines [robots] from another planet. Just imagine: the so-called protein fibrils have "their own" head, body and six legs. A helix of DNA or RNA is rolled into a coil in the head, and its end goes into the body. With its six legs, the phage determines or, more precisely, selects the cell victim, into which it must discharge its DNA or RNA--this is its "vital task." Thus, on the basis of foreign DNA, synthesis of phage offspring begins in the cell. After 20 minutes, 200 new bacteriophages will exit from the

cell. What enormous fertility! There is no need to mention the practical implications to medicine of knowing details about the mechanism of their action.

[Question] Do the scientific interests of the Pushchino scientists end on the level of microorganisms?

[Answer] The center was indeed conceived to integrate research in the field of molecular and cellular biology. But life is ever broadening and complicating our tasks. For example, at the present time we are working on development of synthetic blood. This is already the organic level. True, for the time being our product performs only one of the functions of real blood, it transports oxygen and removes carbon dioxide. In dogs, we are already replacing 70% of their blood with synthetic blood, and experiments are continuing quite successfully.

[Question] Organs and the live organism are, so to speak, the way "up." But what about down, on the level of atoms? Does not such a need arise for modern biologists?

[Answer] There are some trends. The well-known Georgian physicist, E. L. Andronikashvili, academician of the Georgian Academy of Sciences, is developing the idea of "biology of metals." The fact of the matter is that a living organism "consists" of virtually the entire table of D. I. Mendeleyev. True, some elements are present in very small quantities, but nevertheless their role is enormous. For example, a goiter develops if there is an iodine deficiency in the body. I think that we must go down to the atomic level of biological research to explain the nature of such phenomena.

[Question] It appears that each level of research has its own direct practical implications....

[Answer] Life confirms this with conviction. On the molecular level this is gene engineering. Efforts are being made to synthesize genes, transplant them into a microorganism and selectively for it to do what it could not do previously, mainly for the purpose of obtaining biologically active substances, and at relatively low cost at that. One has only to give the microorganisms supplemental food for them to multiply and synthesize the needed protein. Thereafter, the tasks are purely technical--to isolate the biologically active substances.

The second direction is related to the cellular level. So-called cell engineering enables us to transplant any part of a cell. The purpose is to compel the operated cell to function in the required direction. An entire arsenal of microsurgical tools has already been developed at the Institute of Biological Physics.

I would single out one more area of applied use of biological research. It is macrobiotechnology. It was previously combined in the concept of "bionics." It is the use in technological systems of the principles of function of some systems or other that have been "spied" in living nature.

[Question] The "age of biology," "biological revolution" are characteristics of our era that we encounter more and more often. But, even our times perhaps could become among the most important ones in the history of civilization. For a number of countries, there are already global problems--demographic, food supply and environmental pollution. What are the capabilities of today's most revolutionary science, biology, with regard to resolving them?

[Answer] In my opinion, there are already very encouraging and, in many cases, already experimentally tested solutions. Moreover, these problems are purely biological in essence. Even in such a seemingly remote area as energy, biology may render real and effective assistance to physics. We know of "biological methods" of transformation, in particular, of solar energy into electric, which are more effective than technical ones....

In other words, biology can and must make a substantial contribution to the solution of acute problems of development of modern society.

10,657
CSO: 1840/999

UDC 57.082.4:574.24:578/.579

PRODUCING AND RAISING ANTIGEN-FREE MINIATURE PIGS FOR BIOMEDICAL RESEARCH

Moscow VESTNIK AKADEMII MEDITSINSKIH NAUK SSSR in Russian No 5, May 81
(manuscript received 27 Oct 80) pp 42-43

BOLOTSKIKH, L. A., Scientific Research Laboratory of Experimental Biological Models, USSR Academy of Medical Sciences, Moscow Oblast

[Abstract] Cursory description is provided of the incubator used and hysterectomy on miniature pigs designed to yield antigen-free piglets. After removal from the uterus the incubator temperature was adjusted over a period of several days from the initial 30-33°C to 22-25°C, with feeding commencing 1 h after surgery. The animals were on a synthetic nonantigenic Swedish diet consisting of aminozol-glucose and intralipid [sic], 85 ml and 15 ml per 1 kg, respectively. In addition, in the incubator, the piglets also received, per 1 L of the aminozol and intralipid mixture, thiamine (24.5 mg), riboflavin (6.0 mg), vitamin B₁₂ (0.25 mg), FeSO₄ (25 mg), MnCl₂ (3.5 mg), CuSO₄ (8 mg), and KI (0.25 mg). During the period of observation the piglets developed normally reaching a weight of 750 g in 2 weeks and 1100 g in 3 weeks from a birth weight of 250 g. Microbiological studies showed that these were the first antigen-free gnotobiotic piglets obtained in the USSR.

References 3: 1 Czech, 2 Russian.

[237-12172]

MEDICAL DEMOGRAPHY

UDC 612.681:(575.2)

LONGEVITY AND LIFE SPAN OF THE KIRGHIZ SSR POPULATION

Frunze ZDRAVOKHRANENIYE KIRGIZII in Russian No 2, Mar-Apr 81 pp 7-12

[Article by L. S. Burmin, N. I. Kim and V. N. Kirichenko, Frunze State Public Health Department]

[Text] Concern for health and for lengthening the life of the individual is one of the most important social tasks in our country. Socialist society is interested in preserving the life, health, and working ability of the people, in increasing the labor resources, and in strengthening the state's economic might.

The "Basic Directions of the USSR's Economic and Social Development in 1981-1985 and in the Period to 1990" foresee enactment of a system of measures to increase the life span and labor activity of the people and to improve their health.

There is much information to support the fact that during the years of Soviet rule, the active life span of the population increased significantly in our country owing to fundamental socioeconomic transformation, growth in the material and cultural standard of living of the laborers, and improvement of the quality and effectiveness of the medical care provided to the public.

If we are to improve health and physical development, and make real strides in solving the problem of increasing the life span of the broad masses, we would need to penetrate into the essence of the mechanisms, factors, and reserves of active, creative longevity.

Many prominent Soviet scholars have noted, in addition to biological factors, the influence of the social environment upon the health and life span of the individual (A. A. Bogomolets, 1940; A. V. Nagornyy, 1950; D. F. Chebotarev, 1964, 1968, 1976; I. V. Davydovskiy, 1966; etc.).

Problems associated with social gerontology were broadly represented in the last few decades in deep studies performed by B. Ts. Urlanis (1963), A. M. Merkov (1965), R. N. Biryukova (1965), V. S. Luk'yanov (1967), M. S. Bednyy (1967, 1972), G. Z. Pitskhelauri (1967), N. N. Sachuk (1968, 1970, 1972), and others.

Problems associated with the longevity and life span of the population of the Kirghiz SSR began to be studied in the last 20 years. They are eliciting a significant amount of interest because the Kirghiz SSR exhibits a number of unique features in terms of its natural and geographic conditions and the nature of development of its economy and culture.

During the years of Soviet rule the republic achieved major successes in all areas of the economy, culture, and public health.

Longevity is interpreted in research by B. Ts. Urlanis (1963, 1978), D. F. Chebotarev (1968), N. N. Sachuk (1970), M. S. Bednyy (1972), and others as the results of the influence of a complex of factors associated with the people's way of life and the environment upon genetically dependent life span.

According to N. N. Sachuk (1978) the population's longevity is a function and measure of public health, a unique test indicating the favorability of the evolved set of factors associated with the external and internal environment. The concept "population longevity" is not the same as the concept "life span", being instead one of the variants of the latter.

Mortality table indicators are extensively employed as criteria by which to evaluate longevity. Many years of experience have shown that longevity may be characterized most fully by the indicators recommended by N. N. Sachuk (1970):

The longevity index (tabular)--the proportion of persons living up to 80 years in relation to the number living up to 60 years ($l_{80}:l_{60}$, per thousand).

The longevity index (census)--the proportion of persons 80 and more years old in relation to the total number of persons 60 and more years old ($N_{80}:N_{60}$).

The average life expectancy of persons attaining an age of 60 or 80 years and of newborn infants (l_{60} , l_{80} , l_0) indicates the number of years persons of a certain generation will be expected to live on the average. It is assumed in this case that the age-related mortality of this generation would be the same throughout its entire life span as it was in the period for which the mortality tables are compiled.

We compared mortality tables for the Kirghiz SSR population in 1978-1979* using a technique recommended by A. M. Merkov (1959).

Table 1 shows that in a 40-year period, the average life span of the Kirghiz SSR population increased from 43.5 years in 1938-1939 to 66.2 years in 1978-1979. Differences in the average life spans of men and women increased in the 20-year periods. They were 1.7 years in 1938-1939 and 6.7 years in 1958-1959. In 1978-1979 the average life expectancy of newborn infants was 8.2 years longer for women than for men.

As we can see from Table 1, the dominance of the average life span of women over that of men decreases with age. In 1978-1979 the difference in the average life spans of 60-year olds is about 4.0 years, while for persons 80 years old there is practically no difference in the average life expectancy of men and women.

Investigation of the dynamics of average life spans showed that the average life expectancy is increasing owing to a decline mainly in child mortality and partially in mortality at young ages. While in 1938-1939 a 5-year old child could expect to

*We compiled mortality tables for the Kirghiz SSR population for 1938-1939 and 1958-1959 in 1964, and for 1969-1970 in 1971.

Table 1. Average Life Expectancy of the Kirghiz SSR Population

(1) Для лиц, достигших возраста	1938-1939 гг.			1958-1959 гг.			1978-1979 гг.		
	(2) полов	(3) мужчины	(4) жен- щины	объ- пола	мужчины	жен- щины	объ- пола	мужчины	жен- щины
0 (новорожденные) (5)	43,5	43,4	43,5	67,7	63,6	71,8	66,2	61,9	70,1
5 лет (6)	51,2	51,4	50,8	67,2	63,2	71,2	65,8	61,6	69,7
10 лет	47,5	47,4	47,0	62,5	58,5	66,5	61,1	56,8	65,0
20 лет	38,7	38,6	38,0	53,1	49,3	56,9	51,6	47,3	55,4
30 лет	30,6	30,5	30,0	44,2	40,6	47,6	42,6	38,6	46,0
40 лет	22,3	22,2	22,1	35,7	32,5	38,7	34,1	30,5	37,0
50 лет	13,6	13,7	13,5	27,5	24,9	30,0	26,0	22,9	28,3
60 лет	4,7	4,7	4,7	19,9	18,3	21,8	18,6	16,2	20,1
70 лет	—	—	—	13,1	12,5	14,3	12,2	10,9	13,0
80 лет	—	—	—	7,5	6,3	8,7	6,9	6,5	7,1

Key:

- 1. For persons reaching an age of
- 2. Both sexes
- 3. Men
- 4. Women
- 5. Newborn infants
- 6. Years

live not more than 50 years, today he may count on 65.8 years. A 60-year old individual could live an average of another 4.7 years, while today persons of this age may count on adding 18 and more years to their life.

Indicators for average life expectancy for persons 30, 40, 50, 60, and more years old exhibited a decreasing trend in the first 20-year period (1938-1939 and 1958-1959), and a decreasing trend in the second 20-year period (1958-1959 and 1978-1979). This is associated to a certain extent with improvement in mortality records, especially in rural areas. A study of the age and sex indicators of urban mortality in the Kirghiz SSR in 1979 would show that its main causes are diseases of circulatory and respiratory organs, malignant tumors, and so on.

Death due to diseases of circulatory organs rises for men older than 50 years and for women older than 60 years. Mortality due to diseases of respiratory organs is two and more times greater among men 50-60 years old and older than among women.

Reduction of morbidity and mortality in middle age as well as in early and late senile age due to cardiovascular illnesses, diseases of the respiratory organs, and malignant tumors as a result of the implementation of medical and social measures will lead to an increase in life span, and to preservation of persons of employable age in the population.

As in the entire country, significant positive changes occurred in the Kirghiz SSR in the population's longevity during the years of Soviet rule. We can see from Table 2 that the longevity indicators for the Kirghiz SSR are close to their level for the USSR.

Changes in longevity of the population of
the USSR and prerevolutionary Russia in
1900-1970 (according to USSR mortality tables)*

Changes in longevity of the Kirghiz SSR
population in 1938-1979 (from Kirghiz
SSR mortality tables)

Годы (1)	(5) Число доожи- щих до 80 лет (l_{80})		(5) Средняя продол- жительность пред- стоящей жизни 60-летн. (l_{60}) годы		Годы (1)	(2) Число доожи- щавших до 80 лет (l_{80})		(5) Средняя продол- жительность пред- стоящей жизни 60-летн. (l_{60}) годы	
	мужчины (3)	женщины (4)	мужчины (3)	женщины (4)		мужчины (3)	женщины (4)	мужчины (3)	женщины (4)
1896-1897	6,8	7,3	14,0	14,1	23,8	1938-1939	-	4,7	4,7
1926-1927	11,6	18,6	14,9	17,1	28,8	1958-1959	18,9	25,9	22,6
1958-1959	26,6	43,5	17,0	20,6	38,3	1969-1970	24,0	43,1	16,5
1968-1970	23,1	43,6	16,0	20,0	33,6	1978-1979	23,1	43,3	16,2

*VESTNIK STATISTIKI, No 11, 1967, p 92; No 2, 1974, pp 94-95.

Key:

1. Years
2. Number of persons living up to 80 years
3. Men
4. Women
5. Average life expectancy at 60 years (l_{60}), years

Table 3

No. of Persons 80 and More Years Old Per 1,000
Persons 60 and More Years Old

Geographic Area	Both Sexes			Men			Women		
	1959	1970	1979	1959	1970	1979	1959	1970	1979
Urban	79.0	93.4	98.0	69.0	87.9	89.2	89.0	98.7	102.3
Rural	90.9	124.2	146.9	90.7	130.9	159.9	91.3	117.5	139.6
Republic as a whole	85.0	108.8	123.8	79.7	109.5	123.4	90.2	108.1	124.3

Table 4. Longevity of the Populations of Some of the World's Countries in 1960-1970
(From Mortality Tables)*

Country	No. of Persons Living to 80 Years (l ₈₀), per 1000		Average Life Span of 60-Year Olds (l ₆₀), Years	
	Men	Women	Men	Women
1. European Socialist Countries				
USSR	231	436	16.0	20.0
Kirghiz SSR **	231	433	16.2	20.1
Hungary	257	378	15.3	18.1
GDR	278	414	16.1	19.3
Czechoslovakia	244	404	14.6	18.4
2. Economically Developed Capitalist Countries				
Great Britain	233	437	15.1	19.7
Denmark	310	438	17.1	20.6
Netherlands	336	474	16.8	20.5
USA	248	448	16.1	20.9
France	262	471	15.9	20.4
FRG	246	410	15.0	18.8
Sweden	340	463	17.4	20.3
Japan	227	388	15.9	19.2
3. Developing Countries				
Egypt	163	269	15.1	18.0
Argentina	228	376	15.9	19.4
Greenland	52	89	11.7	12.3
Guiana	133	233	13.2	16.2
India	56	67	11.8	13.0
Mexico	267	319	17.1	17.6
Pakistan	197	165	15.6	15.5
Panama	210	300	16.1	18.5

*The years for which indicators were calculated are: for groups 1 and 2: l₆₀--1970; l₈₀--1965; for group 3--1960. USSR data are for 1968-1971. Cited in "Demographic Yearbook," New York, United Nations, 1960-1972.

**Our data for the Kirghiz SSR are for 1979.

The average life span of 60-year olds in the Kirghiz SSR increased in the 40-year period by 3.5 times for men and by almost 4.5 times for women, while the number of persons living to 80 years increased correspondingly by 1.2 and 1.5 times. This indicates presence of a significant reserve for reducing mortality in all age groups, including senile individuals, which would cause a further increase in longevity. A confirmation of this can be found in data showing a consistent increase in the longevity index (Table 3).

Analysis of the longevity indicators for the union republics would show that they are higher in a number of them than in the most highly developed capitalist countries. These indicators are especially high in Transcaucasian union republics and in the autonomous republics of the Northern Caucasus, where they are higher than the countrywide average. The Kirghiz SSR occupies an intermediate position in the country in terms of its longevity indicators, though they are somewhat higher than for other republics of Central Asia and Kazakhstan.

According to the mortality table, longevity in the Kirghiz SSR is on par with that of our nation and some developed countries of the world (Table 4).

Thus these data indicate changes of significant rate and magnitude in the health, longevity, and life span of the Kirghiz SSR population. These indicators are on par with the union averages, and they have some regional features brought about by the influence of natural geographic and socioeconomic factors.

Deep research on the conditions promoting or preventing attainment of old age is a prerequisite of successful solution of the problem of finding effective ways to raise the life span and working ability of the Soviet people, and it would indicate the direction development of public health must take in the republic during the 11th Five-Year Plan. This will be significantly promoted by fulfillment of the tasks foreseen by the "Basic Directions of the USSR's Economic and Social Development in 1981-1985 and in the Period to 1990" and associated with raising the level and quality of medical care for the public, intensifying the effort to prevent disease, and raising the effectiveness of preventive dispensary service.

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11004
CSO: 1840/248

UDC: 616.24-002.5-084(476.6)

INTENSIFYING TUBERCULOSIS CONTROL IN GRODNEŃSKAYA OBLAST, AND SOCIOECONOMIC
EFFECTIVENESS THEREOF

Minsk ZDRAVOKHRANFNIYE BELORUSSII in Russian No 4, Apr 81
(manuscript received 10 Jan 81) pp 4-7

KALECHITS, O. M., BOGDANOVICH, F. A., GEL'BERG, I. S. and CHERNETSKIY, V. D.,
Belorussian Scientific Research Institute of Tuberculosis, Health Department of
Grodno Oblispolkom, Grodno Medical Institute, Grodneńskaya Oblast Tuberculosis
Dispensary

[Abstract] Grodneńskaya Oblast is one of the experimental bases organized to achieve a drastic reduction in incidence of tuberculosis by means of validation and development of an optimum system of control measures, consisting of the following: co-ordination of work of all services in the medical network under the supervision of party and soviet agencies, establishment of a center where monthly information is available about progress, fluorography card file for all of the public over 12 years of age, which flags the groups that must undergo annual check-ups and those with high risk for tuberculosis, also examined annually. Early detection of tuberculosis improved the structure of clinical forms. Tuberculin testing and reinoculation with BCG are practiced in all areas. Fluorography covers 97-99% of the public. The structure of clinical forms of tuberculosis, seasonal distribution thereof and incidence are illustrated, the curves indicating that the epidemiological situation referable to tuberculosis has improved as a result of all of the above measures.

Figures 3; references 3 (Russian).

[247-10,657]

UDC: 616.006.04-052.73-055.2(477.43)

PRIMARY DISABILITY OF FEMALE POPULATION IN KHMEL'NITSKAYA OBLAST DUE TO MALIGNANT NEOPLASMS (1971-1973)

Leningrad VOPROSY ONKOLOGII in Russian Vol 27, No 1, Jan 81
(manuscript received 13 May 79) pp 88-92

SHEYKO, V. P., RAZIN, S. N., KOVAL'CHUK, V. P. and MAMAYEVSKAYA, G. V.,
Vinnitsa Branch of the Denpropetrovsk Scientific Research Institute of
Rehabilitation and Expert Certification of Work Fitness of the Disabled

[Abstract] Prior studies have shown that incidence of cancer localized in the stomach and breast was higher in the central zone of the USSR in 1973 than in southern republics and lower than in northern ones. Khmel'nitskaya Oblast of the Ukraine was selected as a statistical model due to prevalence of and disability due to cancer among women in 1971-1973. Disability rate diminished with growth in morbidity rate over the period studied, which is attributable to improved preventive work, sanitary and hygienic living conditions and greater oncological awareness. Primary disability among women due to oncological disease was referable to all categories of employable women, blue and white collar workers, and farm workers, the highest share being referable to those 40-49 years of age. Most frequent forms of disability-causing cancer were: cervical and breast cancer, followed by cancer of the stomach, ovaries and uterus. It is concluded that the quality of preventive check-ups must be improved, for detection of precancer conditions, and the public must be better informed to become more watchful in this area. Figures 2; references 7: 6 Russian, 1 Western.

[250-10,657]

UDC: 616.12-008.331.1-053.86-055.1

HYPERTENSION INCIDENCE AMONG MALE POPULATION 40-50 YEARS OF AGE IN MINSK

Minsk ZDRAVOOKHRANENIYE BELORUSSII in Russian No 1, Jan 81
(manuscript received 10 Dec 79) pp 30-31

ZBOROVSKIY, E. I., AVRAMEJKO, T. V., APANASEVICH, V. V., FOMINA, R. F.,
KOZLOV, I. D. and LAZYUK, D. G., Laboratory of Social and Preventive Cardiology
(headed by E. I. Zborovskiy, candidate of medical sciences), Belorussian
Scientific Research Institute of Cardiology

[Abstract] Because of the importance of early detection, early, regular and effective treatment of arterial hypertension to prevent cardiac ischemia, the authors made a study of random samples of unorganized men living in districts serviced by 2 polyclinics (No 15, studied in 1978 and No 20, studied in the first half of 1979) in Minsk. As recommended by WHO, systolic pressure of 160 mm or more and diastolic of 95 mm or more was classified as hypertension. Only 942 out of 1359 men asked to participate in this study showed up (69.3% response).

Primary screening revealed that 145 men had hypertension out of 537 referable to polyclinic No 15, and 93 out of 405 in No 20. There was a reliable correlation between hypertension and obesity (18% versus 9% overweight men without hypertension), but not with regard to smoking. There were reliably more men with cardiac ischemia in the hypertensive group. About 30% of the men were not interested in participating in preventive checkups or following preventive recommendations, suggesting that more effective means of health education must be found.

References 3 (Russian).

[251-10,657]

UDC 371.71+313.13-053.5

MORBIDITY AMONG ADOLESCENT STUDENTS

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 4, Apr 81
(manuscript received 23 Oct 80) pp 38-43

KROM, L. I., candidate of medical sciences, Chair of Social Hygiene and Organization of Public Health, 1st Leningrad Medical Institute imeni I. P. Pavlov

[Abstract] Studies were conducted on the morbidity patterns of 15-17 year old students (male and female) at 10 schools in a large city, for 1978-79. The findings showed that there were 1336.9 reported illnesses per 1000 students, with maximum morbidity ascribed to the 16 year olds. The majority of cases, 79.8%, involved the nervous system, respiratory system, and the sense organs. In the overall morbidity, acute diseases accounted for 62.3% of the cases (acute respiratory infections, influenza, other infections and parasitic diseases), while 37.7% of the cases consisted of chronic conditions (tonsillar hypertrophy, adenoidism, vegetative dystonia, hypertension). In general, a comparison of the health of students in schools for general education with that of students in specialized schools indicated that the latter were in better health; this was attributed to better medical selection of specialized schoolchildren who have to assume a heavier schedule. References 6 (Russian).

[238-12172]

UDC 614.86"52"

DIURNAL PERIODICITY OF ROAD ACCIDENTS

Moscow ORTOPEDIYA TRAVMATOLOGIYA I PROTEZIROVANIYE in Russian No 5, May 81
(manuscript received 22 Jul 80) pp 34-37

GLYBIN, L. Ya., Chair of General Surgery, Vladivostok Medical Institute

[Abstract] A correlation was made between the diurnal incidence of road accidents, domestic accidents, and industrial trauma cases, on the one hand, and circadian rhythms on the other. Evaluation of road accidents (excluding alcoholism,

sudden death of driver, inexperienced drivers, etc.) showed maxima at 0200, 0900-1000, 1400-1500, 1800 and 2200 h on the histograms, and minima at 0400-0500, 1100-1200, 1600, 2000-2100, and 2400 h. The corresponding maxima for domestic and industrial accidents were 0900-1000, 1400-1500, 1700, and 2100 h, while the minima were at 0500-0600, 1100-1200, 1600, 2000, and 0-0100 h. These data were apparently not affected by the sex of the subjects. Analysis of physiological rhythmicity (V. V. Rozenblat's cardiorespiratory indexes) revealed physiological maxima at 0500, 1200, 1600, 2000 and 2400 h, and minima at 0200, 0900, 1400, 1800, and 2200 h. These findings indicate that more detailed investigations of the relationship between accident-proneness and circadian indicators of optimum and minimum physiological functional states might make a contribution toward minimizing domestic and industrial accidents. Figures 1; references 9: 2 Western, 7 Russian.

[240-12172]

UDC 612.215([47+57]-17+571.1/.6)

PULMONARY FUNCTION IN NON-INDIGENOUS RESIDENTS OF THE SOVIET NORTHEAST

Moscow TERAPEVTICHESKIY ARKHIV in Russian Vol 53, No 6, Jun 81
(manuscript received 17 Apr 80) pp 95-99

MATVEYEV, L. N., Department of Therapy, Moscow Medical Stomatological Institute

[Abstract] Comparative pulmonary function studies were conducted on 141 non-indigenous male residents (10.42 ± 0.53 years residency; 35.26 years average age) of Magadan and 60 male residents of Moscow (30.62 years average age). The resultant data revealed significant differences in pulmonary function between the two groups, with the changes in the Magadan group being characteristic of irreversible obstructive disease due to compression of the bronchioles.

References 41: 19 Western, 22 Russian.

[241-12172]

UDC 616.153.963'915+616.12-005.4,-055.1-053.8-036.21(470.23-25)

PARTICIPATION CHARACTERISTICS IN EPIDEMIOLOGIC STUDIES ON THE INCIDENCE OF DYSLIPOPROTEINEMIA AND ISCHEMIC HEART DISEASE IN 40-59 YEAR OLD MALES IN LENINGRAD

Moscow KARDIOLOGIYA in Russian Vol 21, No 1, Jan 81
(manuscript received 24 Jul 79) pp 72-77

KATRUSHENKO, A. G. and SHESTOV, D. B., Department of Biochemistry of Lipids and of Atherosclerosis imeni N. N. Anichkov, Scientific Research Institute of Experimental Medicine, USSR Academy of Medical Sciences, Leningrad

[Abstract] Studies were conducted on the attitudes of 40-59 year old males in the Petrograd Rayon of Leningrad toward epidemiologic studies on dyslipoproteinemia

and ischemic heart disease, i.e., individuals who did not participate in a 1975-1977 study in that rayon. The results showed that 70% (563) of the 1093 subjects received health care largely on an out-patient basis at the local polyclinic, 25% (204 relied on the medical services at the place of work, and 5% (35) utilized other health services. It was further ascertained that 55% (443) were indifferent to the study, 239 (29%) had a positive attitude and understood the purpose of the epidemiologic survey, and 16% (130) had a negative attitude. The incidence of refusals was lowest among white-collar workers, and highest among blue-collar workers engaged largely in manual work. The latter group was poorly informed as to ischemic heart disease and hypertension. Figures 3; references 7: 1 Western, 6 Russian.

[242-12172]

UDC 616.352-036.2(479.24-22)

PREVALENCE OF PROCTOLOGIC DISEASES

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 5, May 81
(manuscript received 17 Oct 80) pp 41-45

SULTANOV, G. A., First Chair of Hospital Surgery, Azerbaijan Medical Institute imeni N. Narimanov

[Abstract] An epidemiologic survey was conducted on the prevalence of proctologic diseases of 10,000 rural male and female adults in the Bardinskiy and Mirbashirskiy rayons of Azerbaijan. The results revealed an incidence of proctologic disorders of 380/1000 (vs. reported urban figure of 306/1000). Diseases encountered were: colitis (constipation) 1488 (39% of patients), hemorrhoids--1343 (35.2%), anal fissures--534 (14%), anal pruritus--281 (7.4%), polyps--68 (2%), coccygeal passage--65 (1.7%), and paraproctitis--27 (0.7%). The diseases were attributed to dietary habits and hygienic practices prevalent in the region. Tables 2; references: 4 Russian.

[245-12172]

MEDICINE

AUTOMATIC HEART PACER

Moscow MEDITINSKAYA GAZETA in Russian 18 Mar 81 p 3

[Article by L. Bykova, candidate of biological sciences]

[Text] How can one regulate one's own physical load? The multiprogram autocardio-pacer [cardioleader], AKL-75, which was developed at the All-Union Planning-Technological and Experimental Design Institute of Sports and Tourist Products (VISTI), may be helpful. It checks for coincidence of current heart rate with the programmed rate. If the heart rate is slower than programmed there is a low tone signal and if it is faster, a high tone signal.

One can input 10 programs in the range of heart rates of 100 to 220/min on this instrument. The electrodes recording biopotentials are placed over the heart. The instrument, which weighs 180 g, is battery operated.

The autocardioleader can be used in therapeutic running, resort therapy and in conjunction with rehabilitation measures.

10,657
CSO: 1840/999

UDC 61:06;.3(581)"1980"

FIRST CONGRESS OF THE MEDICAL WORKERS OF THE DEMOCRATIC REPUBLIC OF AFGHANISTAN

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 4, Apr 81
(manuscript received 17 Sep 80) pp 49-51

KRYSHTOPA, B. P., candidate of medical sciences

[Abstract] The First Medical Congress in the Democratic Republic of Afghanistan was held on 16-17 June, 1980 in Kabul in the People's Palace. Participating in the congress were 536 medical workers, including 255 physicians, who represented 30% of the total physician population in that country. The keynote address was delivered by Babrak Karmal, general secretary of the central committee of the People's Democratic Party of Afghanistan, chairman of the Revolutionary Council, and prime minister. He exhorted the medical professionals to greater efforts on behalf of the state and the people, particularly in view of the efforts of the capitalist powers to undermine the achievements of the April 1978 Revolution. The congress was also attended by various Soviet representatives and delegations, as well as those from Korea, India, Vietnam, Mongolia, Hungary, and Bulgaria.
[238-12172]

UDC 355.257.6:616-08-036.868

REHABILITATION OF WORLD WAR II INVALIDS

Moscow KHIRURGIYA in Russian No 5, May 81 (manuscript received 8 Sep 80) pp 71-74

KOLESNIKOV, Yu. P., doctor of medical sciences, Chair of Traumatology, Orthopedics, and Military Field Surgery, Kursk Medical Institute, and the Chair of Traumatology, Orthopedics, and Military Field Surgery, Voronezh Medical Institute

[Abstract] A brief survey is presented of the medical and surgical management of World War II invalids with late sequelae on an out-patient basis. Particular care has been required in dealing with disabling cases of osteomyelitis resulting from gunshot wounds; emphasis is placed on the need for greater utilization of Ilizarov's apparatus in treating bone defects and joint dysfunctions.

References: 3 Russian.
[239-12172]

UDC 613.67+356.33₁:628.84:621.384.52

OZONIZATION OF AIR IN LIVING QUARTERS

Moscow VOYENNO-MEDITSINSKIY ZHURNAL in Russian No 3, Mar 81 pp 41-42

ZAKHAROV, M. P., candidate of medical sciences, captain in the Medical Service
and DMITRIYEV, M. T., doctor of chemical sciences

[Abstract] Studies were conducted on the well-being of individuals whose sleeping quarters were maintained at an ozone concentration of 20-25 $\mu\text{kg}/\text{m}^3$ for 3 days. The results showed that as a result of night-time exposure to ozone there were 24.8-64.3% fewer complaints of somnolence at work, irritability, and lack of fresh air. Data are presented in tabular form.

[244-12172]

PHYSIOLOGY

SIXTH INTERNATIONAL NEUROBIOLOGICAL SYMPOSIUM ON TRAINING AND MEMORY

Moscow USPEKHI SOVREMENNOY BIOLOGII in Russian Vol 91, No 2, Mar-Apr 81 pp 308-312

[Article by R. I. Kruglikov]

[Text] This symposium convened on 2-6 July 1980 in Magdeburg (GDR). It was organized by the Institute of Pharmacology and Toxicology of the Magdeburg Medical Academy within the framework of IBRO (International Brain Research Organization) and "Interbrain." Scientists from socialist countries, as well as the United States, Great Britain, France, Holland, Switzerland, Brazil and others participated in this symposium.

H. MATTHIES delivered a paper summarizing the numerous studies of the staff of the Institute of Pharmacology and Toxicology, Magdeburg Medical Academy, covering a period of many years. He stressed the effectiveness of comprehensive investigation [in many aspects] of the same model of behavior, in this instance visual differentiation in a Y-shaped maze with the use of electrocutaneous reinforcement. Having discussed in detail the neurophysiological, ultrastructural and neurochemical correlates of visual differentiation, the author called special attention to the changes in glycoprotein synthesis in the brain demonstrated by incorporation of ^3H -fucose in brain tissue proteins. In the opinion of the speaker, this is indicative of the special role of changes in metabolism of glycoproteins contained in neuronal membranes in processes of learning and formation of memory. Of great interest are the phenomena of deferred activation of protein synthesis, which the author and his colleagues demonstrated after completion of training, which perhaps reflect the dynamics of the process of consolidation of a developed conditioned association. A significant part of the paper of Matthies dealt with involvement of neuromediator systems in integrative activity of the brain, as well as changes in total protein synthesis. The author validated the conception of mechanisms of stable variations of chemoreactive properties of neuronal membranes during training on the basis of experimental findings. According to this conception, activation of specific afferent input, which is most likely of a cholinergic nature, leads to conformational changes in the subsynaptic membrane. These changes are relatively transient. But if an "unconditioned" input and inputs through which emotional and motivational influences are exerted on the neuron (these inputs are monoaminergic) concurrently with or soon after activation of the "conditioned" input, there are intraneuronal metabolic changes due to triggering of the system of cyclic nucleotides, and these changes lead to stabilization of conformational alterations of the cholinergic subsynaptic membrane. As a result, there is long-term increase in effectiveness of the input in question, which could serve as the basis for long-term retention of an engram.

With regard to discussion of the two main issues of the symposium--mechanisms and models of nerve flexibility and mechanisms of involvement of the hippocampus in training and memory processes--much attention was devoted to the role and mechanisms of participation of neuropeptides in integrative activity of the brain. Their exceptionally high physiological activity, uniqueness of effects and endogenous origin all determined the increased interest in the neuropeptide problem. Dutch researchers delivered comprehensive papers on various aspects of the effects of neuropeptides. In the paper of P. R. BAR et al., extensive data were submitted on phosphorylation of synaptic membrane proteins under the influence of neuropeptides and properties of one of the protein kinases of synaptic membranes (its sensitivity to Ca^{2+} , kal'modulin, ACTH), as well as a special protein, B-50, the substrate of the described protein kinase. Immunocytochemical methods demonstrated the localization of this protein in different parts of the brain. The authors were able to gain important and interesting information about metabolism of synaptic membrane phosphoinositides, both *in vivo* and *in vitro*. The influence of enkephalins on phosphorylation of membrane proteins was demonstrated in surviving hippocampus sections. The authors concluded that phosphorylation of membrane proteins plays an important role in the mechanism of action of neuropeptides.

B. BOHUS (Holland) delivered an important paper summarizing the results of a well-known line of research. Studies of the involvement of different neuromediatory systems in expression of the effects of neuropeptides on learning and memory yielded convincing evidence of the decisive role of catecholamines, primarily nor-epinephrine, in these effects. According to this author's data, noradrenergic terminals in limbic structures must be intact for expression of the effects of neuropeptides. The following is the chief proof of this thesis: after injection of vasopressin into the sutural nuclei or dorsal hippocampus he observed marked improvement of the consolidation process; prior (before vasopressin) injection in these structures of 6-hydroxydopamine, which destroys noradrenergic terminals, totally prevented the effects of vasopressin. It is interesting to note that injection of vasopressin in the amygdaloid complex improves recall of the engram, rather than consolidation, and it also prevents development of amnesia induced by oxytocin. The general conclusion of the work of Bohus was that peptidergic modulation of memory processes is effected via monoaminergic neuromediator systems.

The well-known Brazilian researcher, I. IZGUIERDO, advanced in his paper the conception of existence of an endogenous, specialized amnesia-producing mechanism in the rat brain. The function of this mechanism is implemented by β -endorphins and, perhaps, other endogenous opioids. One of the most convincing arguments in favor of this conception is the improvement in retention of engrams and greater effectiveness of the consolidation process when opioid receptors are blocked with naloxone. In addition, the author observed partial amnesia after giving experimental animals certain opioids immediately after training. It must be noted that the author tested retention of developed reflexes 1 day after their development in most series of experiments. According to his data, the action of the amnesia-producing mechanism is related to depression of dopaminergic and β -adrenergic systems: the improvement of consolidation elicited by naloxone is enhanced by amphetamine and blocked by haloperidol and the β -adrenoblocking agent propranolol (but not by α -adrenoblocking agents). One of the author's most important conclusions is that endogenous opioids demonstrate a marked effect on learning and memory processes in concentrations that are 100-1000 times lower than those having an analgesic effect. It should be stressed that this conclusion, along with some of the recently published data, are indicative of the fact that the spectrum of action (and role) of endogenous opioids goes far beyond their analgesic action.

The information reported by A. ERMITSCH et al. (GDR) is very important to comprehension of the mechanisms of action of endogenous opioids, in particular, vasopressin, on the consolidation process. These researchers discovered that there was significant increase in permeability of the hematoencephalic barrier to substances utilized by the brain in the process of engram consolidation, in particular, to orotic acid, under the influence of vasopressin. The authors believe that the beneficial effect of vasopressin on the consolidation process is attributable, to a significant extent, to expressly this circumstance.

J. MARTHINEZ (United States) and H. RIGTER (Holland) made a comprehensive comparative analysis of the effects of metenkephalin and leuenkephalin. They succeeded in demonstrating substantial differences between the effects and mechanisms of action of these two opioids, which impair development of avoidance reactions. Unlike metenkephalin and leuenkephalin, their agonists, etorphin* and morphine, as well as α -, β - and γ -endorphins do not impair development of the avoidance reaction. Blocking the opioid receptors with naloxone prevents the effects of metenkephalin, without affecting those of leuenkephalin. At the same time, naloxone potentiated the effects of ACTH₄₋₁₀. Medullectomy of the adrenals, which are the peripheral reservoir of enkephalins, eliminated the effects of enkephalins and ACTH₄₋₁₀ entirely.

A. N. CHEPKOVA and V. G. SKREBITSKIY (USSR), who conducted experiments on surviving hippocampal sections, demonstrated prolongation of posttetanic potentiation in the hippocampus under the influence of vasopressin and shortening of this potentiation under the influence of the β -adrenoblocking agent, propranolol. The Irish researchers, S. EARLEY and B. LEONARD, discovered that testosterone had a marked effect on nonsexual forms of behavior.

Special attention was devoted in the symposium proceedings to the role of the different neuromediator systems and their interaction in learning and memory processes. Thus, E. KAMMERER et al. (GDR) submitted data on changes in ³H-choline capture and incorporation thereof in ³H-acetylcholine by hippocampal tissue from the brain of rats, in which visual differentiation was being developed. A comparison of indicators of ³H-choline capture and incorporation in ³H-acetylcholine in rats differing in effectiveness of the consolidation process (and, consequently, with different capacity for retaining developed reflexes) led the authors to discover that capture is greater in animals with better retention of temporary associations than in animals with poor retention thereof. Since demonstration of ³H-choline capture was made 1 week after testing retention of reflexes, the differences found apparently reflect congenital distinctions of conditioned reflex activity. Similar data, indicative of activation of cholinergic mechanisms of the brain during development of conditioned reflexes, were obtained by the Dutch researcher, W. RAAIJMAKERS.

The comprehensive paper of J. McGAUGH (United States) discussed in detail the role of peripheral catecholaminergic mechanisms in the consolidation process. According to his data, retention of conditioned defense reflexes is improved both after administration of α -amphetamine, which penetrates the hematoencephalic barrier, and 4-OH-amphetamine, which does not penetrate into the brain and exerts its influence on engram consolidation through some peripheral elements. Adrenal medullectomy eliminated the effects of both amphetamines. The content of a paper delivered by another American researcher, P. GOLD, who demonstrated that effectiveness of the consolidation process depended on the norepinephrine level in the brain, was similar to that of the paper of McGaugh.

*Translator's note: Could be typo for ethomorphine.

In recent times, researchers in the GDR have been paying much attention to dopaminergic mechanisms of the brain as related to their involvement in learning and memory processes. G. GRECKSCH and H. MATTHIES discovered that intrahippocampal administration of dopaminergic agonists, apomorphine and ergometrine, immediately after developing visual differentiation improved retention of reflexes, while administration of the antagonist, haloperidol, worsened retention thereof, which is a direct indication of involvement of dopaminergic mechanisms of the hippocampus in the consolidation process. According to the data of I. SCHMIDT and J. OEHLER from the GDR, prolonged isolation of rats or chronic administration of haloperidol to them leads to microionophoretically demonstrable intensification of inhibitory reactions of striatal neurons to dopamine and change in sensitivity of these neurons to acetylcholine and serotonin, but not gamma-aminobutyric acid, glutamate or substance P.

Convincing evidence of dopaminergic mechanisms in the hippocampus was offered in the paper of H. SCHRÖDER et al. (GDR). In particular, addition of haloperidol or high concentrations of K⁺ to the incubation medium with surviving hippocampal sections caused release of dopamine from the sections.

The paper of R. JORK et al. (GDR) dealt with the involvement of dopamine in regulation of glycoprotein synthesis in the rat hippocampus. According to their data, obtained on surviving hippocampus sections, there was significant and reliable enhancement of uptake of ³H-fucose in total proteins under the influence of the dopaminergic agonists, dopamine and apomorphine. Addition to the incubation medium of agents that block dopamine receptors prevented this effect. Increased uptake of fucose in hippocampal proteins was also observed in experiments *in vivo* following intrahippocampal administration to rats of apomorphine. It was demonstrated that cAMP is involved in the described effect.

The paper of R. I. KRUGLIKOV (USSR) submitted data on the modulating effects of monoaminergic systems on the cholinergic system, and the reciprocal effects of monoaminergic neuromediator systems. According to his data, a dosage of scopolamine that was not sufficient to induce amnesia in intact animals led to profound amnesia in animals with destroyed locus coeruleus or with reduced brain serotonin level, induced by parachlorophenylalanine. It is concluded from these data that one of the conditions for proper function of cholinergic mechanisms of the brain is the integrity and proper function of monoaminergic neuromediator systems. A study of interaction between monoaminergic systems revealed distinctive asymmetry: the catecholaminergic system has a stronger effect on the functional state of the serotonergic system than the latter has on the catecholaminergic system. One of the important findings of this work was that the effect of intervention in activity of the neuromediator systems depended on the nature of intervention (pharmacological, surgical). B. ODERFELD-NOWAK and A. POTEMPSKA (Polish People's Republic) submitted in their paper comprehensive data on interaction between hippocampal neuromediator mechanisms. K. ROUSSINOV and D. YONKOV (People's Republic of Bulgaria) discovered that blocking central m-cholinoreactive (but not n-cholinoreactive) systems prevents improvement of fixation and retention of conditioned associations induced by stimulators. Interestingly enough, to assess retention of conditioned associations, the authors did not use repeated development thereof, but counted the conditioned reactions to 10-fold delivery of a conditioned stimulus to experimental animals. The main conclusion of this study was that stimulators had an alleviating effect on fixation (and retention) of conditioned associations with the involvement of cholinergic mechanisms.

Several of the papers submitted new data on metabolism of macromolecules during training. B. LOSSNER et al. (GDR) demonstrated that activation of protein synthesis in the hippocampus during development of visual discrimination is undulant in nature. The first activation wave appears immediately after a training session and the second several hours later. It is interesting to note that activation of protein synthesis is not the same in the case of stimulation of the septohippocampal input. This is indicative of some specificity of the changes in protein metabolism during training. Data on the distinctions of glycoprotein synthesis in the brain during development of visual discrimination were submitted in the paper of N. POPOV (GDR). A. ROUTTENBERG (United States) found a phosphoprotein in the brain, contained in synaptic membranes, which is readily phosphorylated in the course of training. Some evidence was obtained to suggest that this phosphoprotein can remain in such a phosphorylated state for a long time and participate in retention of the engram.

R. A. DANILOVA (USSR) submitted a paper dealing with the immunological approach to investigation of structural changes in synaptic membranes related to learning. The data obtained by this speaker, together with L. G. Voronin and T. G. Zhangel'dina, revealed that there are specific antibodies in rabbit antisera to the fraction of synaptic membranes of the "trained" rat brain. Intraventricular administration of antiserum to intact animals accelerated development of the same skill. Using the spinal probe method, the authors discovered a difference in structural state of synaptic membranes of control and trained rats, as well as presence of dissimilar induced conformational changes in the synaptic membrane fraction during interaction with antibodies. The paper of H. RAHMANN (FRG) dealt with the changes in metabolism of synaptic membrane gangliosides with certain forms of training.

Several papers discussed the distinctions of bioelectrical activity of the hippocampus during training. G. BUSAKI et al. (Hungarian People's Republic) made a comprehensive analysis of electrical activity of the dorsal and ventral hippocampus during development of differentiation and defense reactions in cats and classical conditioned reactions in rats. They demonstrated differences in spectral composition of hippocampal activity during reactions in response to a signal and voluntary reactions.

C. VANDERWOLF and K. OSSENKOPP (Canada) concentrated in their paper on changes in various components of slow-wave activity of the hippocampus and neocortex during different forms of motor activity. According to their data, theta waves, which have a direct bearing on the process of engram consolidation in the opinion of some researchers, actually reflect the distinctions of animals' motor activity, regardless of prior development of conditioned reflexes, and consequently cannot be construed as the electrophysiological correlate of the consolidation process. There were many interesting neurophysiological and neurochemical data in papers dealing with the distinctions and mechanisms of prolonged posttetanic potentiation (PTP) in the hippocampus. T. OTT et al. (GDR) used a clever methodological procedure for concurrent registration of plastic changes on the behavioral and neuronal level. In their experiment, stimulation of the "perforant" [?] pathway served as a conditioned stimulus. By recording the monosynaptic responses in the area dentata to the conditioned stimulus, the authors observed stable changes therein during development of the avoidance reaction. Changes in responses were observed only in animals in whom conditioned reflexes were developed and not in animals who did not develop reflexes, in spite of delivery of the combinations. The paper of H. RUTHRICH et al. (GDR) submitted data to the effect that, after development of visual differentiation in a Y-shaped maze in rats, the latency period of the

population [?] spike induced in the area dentata by stimulation of the perforant pathway diminished, while its amplitude increased. These changes were more marked in animals with good retention of developed reflexes.

A very interesting paper by a team of Dutch researchers--L. DA SILVA et al.--dealt with comprehensive analysis of the possible role of phosphorylation of synaptic membranes in PPP mechanisms. Using surviving sections of the hippocampus, the authors found that tetanization of perforant fibers was associated with more intensive incorporation of ^{32}P -phosphate in proteins of hippocampal structures. Electric stimulation of the perforant pathway in a slow rhythm, which does not lead to development of PPP, was not associated with changes in phosphorylation. Stimulation of hippocampus sections placed in a calcium-free medium was also not associated with intensification of phosphorylation. On the basis of these findings, the authors concluded that electric stimulation inducing development of PPP increases the activity of one of the protein kinases that phosphorylates a special protein, 50B.

M. KRUG et al. (GDR), who studied the neurochemical basis of PPP in the hippocampus, demonstrated that postsynaptic structures are involved in this phenomenon. Intra-hippocampal administration of diethyl glutamate, which blocks glutamate receptors, impairs or prevents development of PPP with tetanization of the perforant input. Since glutamate serves as a mediator of the monosynaptic perforant pathway according to current data, the findings of these authors are a direct indication of the role of mediator-receptor interactions in expression of PPP.

V. I. GUSEL'NIKOV and A. S. PIVOVAROV (USSR) submitted data on changes in parameters of the electroexcitable membrane of cortical neurons in the turtle with habituation and posttetanic changes in reactivity. As shown by these authors, there was a reliable change in latency of the spike response to intracellular electrical stimulation, spike potential and input resistance of the neuron as a result of these factors. In the course of habituation, there was a decrease in excitability in response to a monotonously delivered stimulus and increase thereof in response to extra stimuli.

Some interesting data on the possibility of developing an analogue of a conditioned reflex in a totally isolated neuron of the apple snail [*Helix pomatia* L.] were submitted by R. SINZ et al. (GDR, USSR). Subliminal amounts of acetylcholine delivered to the neuron served as the conditioned stimulus and supraliminal electric stimuli served as reinforcement. After several combinations, the neuron began to react to a conditioned stimulus in the form of an action potential. No increase in sensitivity to acetylcholine was observed after delivery of acetylcholine numerous times or numerous intracellular depolarizing electric stimuli, as well as uncombined delivery of stimuli or presentation thereof in reverse order.

According to the data of B. F. TOLKUNOV (USSR), the polysensory afferent flow changes into a specialized sensory one by means of depression or alleviation of its different components due to corticofugal mechanisms of control of convergence of afferent stimuli. As a result, a neuronal model is formed of the meaningful sensory image-signal, which can be fixed in long-term memory and used in forming behavior.

There was further confirmation of the possibility of controlling the process of engram consolidation in the proceedings of this symposium. V. BLOCH and S. LAROCHE (France), developing and enlarging upon their prior studies, demonstrated that mild stimulation of the mesencephalic reticular formation after delivery to rats of

combinations of sound and electrocutaneous stimuli accelerates development of a conditioned reflex and change in concurrently recorded neuronal activity of the hippocampus. This change persists for a long time in "stimulated" rats. In a special series of experiments, the authors stimulated the mesencephalic reticular formation after each stimulation of the perforant pathway. Under these conditions, PPP occurred sooner and persisted for a longer time than in control animals. The authors used these factors for further validation of the consolidation hypothesis.

H. RUTRICH et al. (GDR) observed improved consolidation of temporary associations in old rats under the influence of repeated administration of orotic acid. Giving rats L-fucose 30 min before development of visual discrimination improved retention thereof after 1 day (W. WETZEL et al., GDR).

In addition to the ones discussed above, a number of interesting papers dealing with other aspects of neurobiology of learning and memory were delivered at this symposium: ontogenetic (J. MYSLIVECEK, CSSR; J. HASSMANNOVA et al., CSSR), morphological (R. SERSLING, T. SCHUSTER, GDR), pharmacological (J. VETULANI et al., Polish People's Republic) and other aspects.

One of the most remarkable features of the papers delivered at this symposium was their complex nature, which usually included physiological and biochemical data. Evidently, this approach reflects the current stage of development of the problem of learning and memory, which is acquiring an interdisciplinary essence. We should also mention the increased interest of researchers in neurochemical aspects of training and memory in general, and in the problem of neuropeptides in particular. We can expect that research in expressly this direction will develop the most intensively in the next few years.

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BLOOD PLASMA CATECHOLAMINES OF AUGUST AND WISTAR RATS IN THE PRESENCE OF EMOTIONAL STRESS

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR in Russian Vol 67, No 4, Apr 81
(manuscript received 16 Apr 80) pp 516-523

KVETNANSKY, R., BELOVA, T. I., OPRSHALOVA, Z., PONETS, I., IINDRA, A. and DUSHKIN, V. A., Department of Adaptation (headed by R. Kvetnansky), Institute of Experimental Endocrinology, Slovak Academy of Sciences, Bratislava, CSSR; Laboratory of Functional Morphology of the Central Nervous System and Electron Microscopy Office (headed by T. I. Belova), Institute of Normal Physiology imeni P. K. Anokhin, USSR Academy of Medical Sciences, and Laboratory of Biological Models (headed by V. A. Dushkin) of the USSR Academy of Medical Sciences, Moscow

[Abstract] The serious cardiovascular disturbances associated with stress have prompted intensive experimental studies of the mechanisms of preserving self-regulation of physiological functions under stress. This is a continuation of the authors' study of the role of catecholamines in forming autonomic reactions associated with stress. Experiments were conducted on 9 Wistar and 10 August male rats of the same age, whose caudal artery was catheterized under pentobarbital anesthesia, for administration of heparin. Stress was induced by immobilization in separate cages. Blood was taken after 20 and 120 min of immobilization and blood pressure was measured in the 60th and 120th min. After sacrificing the animals determination was made by the radioenzymatic method of concentration of catecholamines: O-methylation of catecholamines using ^3H adenosyl-methionine, catechol O-methyltransferase, separation of O-methylated derivatives by thin-layer chromatography. Epinephrine and norepinephrine levels in blood plasma changed differently in the two strains of rats, and both presented substantial fluctuation of blood pressure, which reverted to normal after 2 h of stress in Wistar rats, but not August, suggesting that cardiovascular functions are more stable in the presence of stress in the Wistar rats. Figures 5; references 12: 4 Russian, 8 Western.

[249-10,657]

HUMAN FACTORS

UDC: 658.382.7

RHYTHMS AND BIORHYTHMS OF WORK

Moscow MASHINOSTROITEL' in Russian No 5, May 81 pp 13-14

TKACHENKO, V. V., chairman of the Moldavian Republic Committee of Machine and Instrument Making Workers Trade Union

[Abstract] An incident is described of using biorhythmology to select an individual for preliminary inspection of a new program for automated control of the Kishinev Refrigerator Plant. The substance of biorhythmology theory is described as consisting of three separate cycles in each person, starting at birth: 23-day physical cycle, 28-day emotional or sensory cycle and 33-day intellectual cycle, each of which has negative and positive periods. Studies made at the above plant and at the Mikroprovod [Microwire] Scientific Production Association in Kishinev revealed that the accident rate is higher during critical or dangerous periods of the cycles at both facilities, and both enterprises began to use the biorhythm system to place and transfer workers, particularly those for whom there were potentially dangerous working conditions. As a result, industrial traumatism was drastically reduced, quality and productivity of work improved, fewer mistakes were made. This new approach is presently being introduced at other plants in the same economic sector and it is believed to have played an important role in preventing industrial traumatism.

[216-10,657]

UDC 612.821.2.017.2:613.12

PSYCHOPHYSIOLOGIC ANALYSIS OF CHANGES IN HUMAN MEMORY DURING ADAPTATION TO NOVEL CLIMATIC AND GEOGRAPHIC ENVIRONMENTS

Moscow VESTNIK AKADEMII MEDITSINSKIKH NAUK SSSR in Russian No 5, May 81
(manuscript received 27 Oct 80) pp 68-71

NIKOLAYEVA, Ye. I., Institute of Physiology, Siberian Branch, USSR Academy of Medical Sciences, Novosibirsk

[Abstract] Psychophysiologic studies were conducted on several groups of men subjected to novel climatic and geographic environments (adaptation to the monsoon

climate of the southern Kuriles after a transmeridional flight--a 4 hr zone-time shift, in a 1976 expedition--, adaptation to the Altay, 2600 m, 1977, and to the high-altitude Pamir, 3600 m, 1978. The same personnel were not duplicated in the three expeditions) to test the effects on memory functions. The studies involved EEG, EKG, and galvanic skin response recordings in relation to presentation with neutral and emotionally significant words, as well as observations on sleep-wakefulness cycles, orientation to indifferent sound stimuli, etc. The resultant data indicated that in the early stages of adaptation, regardless of the climatic and geographic surroundings, recall of neutral words deteriorated while that of emotional words was significantly enhanced. Subsequently, recall of emotionally meaningful words returned to physiologically normal levels, accompanied by normal recall of neutral words. The findings were interpreted to reflect initial depression of CNS and its subsequent recovery as adaptation progressed. Figures 1; references 11: 3 Western, 8 Russian.
[237-12172]

UDC 613.68+359.1]:612.017.11.014.49

INCREASING BODILY, NON-SPECIFIC RESISTANCE OF SAILORS AT SEA

Moscow VOYENNO-MEDITSINSKIY ZHURNAL in Russian No 3, Mar 81 pp 44-45

NOVIKOV, V. S., candidate of medical sciences, captain in the Medical Service and ARZUMANOV, A. A., captain in the Medical Service

[Abstract] Investigations were conducted on 74 19-20 year old sailors to determine the most effective means of enhancing non-specific resistance at sea. The subjects were divided into a control group, a group irradiated with UV light (1/4 biodose increasing to 2.5 biodose over a 10 day period), oxygen inhalation group (30 min/day for 10 days), an electrosleep group (60 min/day for 10 days; 30-40 Hz current for 5 min, gradually decreasing to 6-10 Hz), and a group assigned physical training (30 min/day) in combination with physical tempering (rub-downs with sheets soaked in water at room temperature and UV irradiation). In addition, all sailors were given 100 mg/day of vitamin C. Evaluation of various parameters reflecting the functional state of the immune system showed that physical training and tempering were most effective in enhancing natural immunity.

[244-12172]

UDC 613.693:[612.821.8+612.825.5].014.477

USING VIBROTACTILE SIGNALS IN ASSESSING MAXIMUM PERMISSIBLE FLIGHT OVERLOAD

Moscow VOYENNO-MEDITSINSKIY ZHURNAL in Russian No 3, Mar 81 pp 43-44

PASTUSHENKOV, A. V., candidate of medical sciences, colonel in the Medical Service, GRISHCHENKO, V. V., major in the Medical Service, PASHCHENKO, P. S., senior lieutenant in the Medical Service, and LEMAK, I. V., major in the Medical Service

[Abstract] Vibrotactile signals in the 10-15 Hz range were applied to the lower third of the right forearm of pilots to serve as additional sensory input of overload in flight. Pilots' visual checking of the accelerometer decreased from 89% while approaching maximum load in Nesterov's loop to 14% if the pilots were provided with the vibrotactile input; the respective figures while banking were 78 and 45.5%. Furthermore, the mean fixation time on the accelerometer was 0.56 ± 0.16 sec without the tactile signals and 0.3 ± 0.09 sec with them ($P < 0.5$). The results showed that the vibrotactile signals enabled the pilots to concentrate more on other instruments during the performance of loops and banking maneuvers, and eased the emotional stress, as indicated by a lower heart rate (130 ± 4.6 /min, $P < 0.005$) when the tactile signal system was employed than when it was not (139 ± 4.7 /min, $P < 0.005$).

[244-12172]

PSYCHOLOGY

PROBLEMS OF INVESTIGATING PSYCHOLOGICAL CLIMATE IN WORKER GROUPS

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: BIOLOGIYA in Russian No 11, Jun 80
(manuscript received 22 Jan 80) pp 111-114

[Article by N. Yu. Khryashcheva and O. S. Mikhalyuk]

[Text] The psychological climate is one of the most general and widely used features of a worker group at the present time. Along with the concept of "psychological climate," other terms are also used extensively: "sociopsychological climate," "emotional climate," "Moral-psychological climate," "psychological atmosphere."

The increased interest displayed by representatives of social sciences in the study of the psychological climate is related primarily to the fact that optimization of the psychological climate is an important means of improving the efficiency of work. According to the data of a number of researchers [1], the psychological climate has an appreciable effect on such objective indicators of group performance as productivity of labor, its quality, work discipline, personnel turnover, etc. The psychological climate plays an equally important role in the moral upbringing of workers. In groups where the situation is good, public approval and encouragement are given to the forms of behavior that conform with the standards of communistic morale--conscientious attitude toward work, collaboration and mutual help, communistic high-mindedness [being principled], fairness, etc. Moreover, a good psychological climate makes a man's life in a group more interesting and meaningful. It is also very important to comprehensive development of abilities and talents of each member of a team.

In recent years, many works have been published that deal specially with the study of the psychological climate [2]. They not only describe the results of specific empirical studies, but make an attempt at theoretical analysis of this phenomenon. However, the task of defining the concept of "psychological climate" in a group of workers is still a pressing one. Analysis of the definitions of this concept proposed by Soviet psychologists indicates that most of them merely list the different indicators of the psychological climate. We can call such definitions differentiated. Much less frequently, authors offer an integrative, generalized definition of the concept of "psychological climate." The state of group psychology is often singled out as the integrating feature. Thus, Ye. S. Kuz'min et al. believe that "psychological climate must be construed as a sociopsychological state of a primary industrial group that reflects the nature, content and orientation of the actual psychology of group members" [3]. Definitions of this type describe rather well the theoretical model of psychological climate, since they delve into the

mechanisms of its formation, but for the purposes of empirical studies they are too general and do not point the way to measure it directly.

Some investigators view psychological climate as the emotional set, stable mood in a group. K. K. Platonov writes: "The sociopsychological climate in a group is determined by the stable mood of the group, upon which depends the degree of activity toward reaching the goals before it" [4].

Differentiated definitions contain a set of characteristics or indicators of the psychological climate. The definition offered by Yu. A. Sherkovin is an example of such definitions: "The sociopsychological climate is a specific phenomenon that is made up of the distinctions of man's perception of man, mutual ability to communicate, mutually experienced feelings, evaluations and opinions, readiness to react in a specific way to the words and deeds of others" [5].

On the basis of such a definition, it is sufficient to measure the variables it lists to obtain a set of indicators describing the degree of development and distinctions of the psychological climate in the worker group studied. With such an approach, the main task is to select an exhaustive list of characteristics of psychological climate. A special analysis we made of differentiated definitions of psychological climate revealed that most authors mention the following features the most often: "horizontal" relations, "vertical" relations, attitude toward work, affect [mood], satisfaction with different elements of the socioindustrial situation (working conditions, organization of work, wages, etc.).

It should be noted that the level of the psychological climate is not characterized so much by the nature of, for example, objective working conditions for members of a team as by their perception and evaluation of team members. For this reason, the psychological climate may differ in two groups with objectively identical working conditions, content of work, wages, etc. The evaluation of various aspects of the work situation by members of a team of workers depends, in particular, on their prior life's experience, individual distinctions, value orientations, sets, etc. Consequently, the sociodemographic characteristics and psychological distinctions of members of a work team emerge as one of the factors that form the psychological climate in a given group. Knowledge and consideration of factors that influence formation of the psychological climate in a group is of both theoretical and practical significance, since it permits regulation of its formation within certain limits.

In addition to the one we just mentioned, we can single out factors that affect the psychological climate of a group of workers such as the nature of industrial [working] relations in the society of which a given team is a member; nature and conditions of work; distinctions of work done by management bodies and self-management of the organization; nature of supervision over the group; extent to which there is a coincidence between the official and unofficial [formal and informal] structure of the group, group size, etc. It must be borne in mind that some of the formative factors may also serve as indicators of development of psychological climate in a worker group, for example, nature of management, social activities of group members, with consideration of emotional, cognitive and regulatory components, of the listed objects, phenomena and processes.

The results of the studies that we pursued for 3 years of several industrial worker and scientific research groups (totaling about 700 people in all) revealed that

workers rated their relations with their fellow workers the highest, of the elements that were singled out in the socioindustrial situation. The indicators of satisfaction with "horizontal" relations are closely linked with the frequency of contact between team members away from the job, as well as frequency of discussion in the group of matters directly related to the job. Low indicators of satisfaction with relations with fellow workers are indicative of an overtly poor state of affairs in the group. This is associated with a drastic drop in the rating that workers give their group as a whole, lower indicators of solidarity, higher level of conflicts. The latter was higher with reference to the business aspect in all groups studied than in the area of interpersonal relations. This difference is apparently attributable to the fact that it is primarily work that unites people in worker groups. For this reason, business matters are more often the cause of conflicts than personal ones related, for example, to the psychological distinctions of group members. To check this assumption, a special study was made, in the course of which the causes of conflicts in industrial groups and groups employed at distant hydrometeorological stations were compared. The employees of such stations are together when they are off work also, they are bound not only by their work but life together. The members of the groups studied mentioned specific reasons for conflicts. In the industrial groups, 95% of all mentioned reasons for conflict were referable to the work situation, and at the hydrometeorological stations 77% were referable to the personal aspect. Thus, the difficulties that employees of hydrometeorological stations experience in organization of living conditions, living together, are more frequent causes of conflicts than work matters. The long period of living together, 3 or more years, plays some role in this respect. In the course of antarctic expeditions, which are of much shorter duration (about 1 year), at first conflicts arise because of the work and it is only later, as time passes, that they move to the area of interpersonal relations.

Another pattern that was established in the study is that the mean indicators of group ratings of interpersonal relations, both "horizontal" and "vertical," as well as referable to their specialty, were found to be reliably higher than the mean indicators of group ratings of working conditions and wages. Analysis of the correlations between different parameters of the psychological climate revealed that the rating of relations with fellow workers, with the immediate supervisor, evaluation of conflict situation referable to work and personal matters, as well as rating of wages and specialty, constituted the "core" of the set of parameters used.

The level of development of the psychological climate in the worker groups we studied is not the same. For this reason, the general task is to upgrade the groups that are behind up to the level of the advanced ones, with the use and introduction of existing positive knowhow. The choice of ways and means of improving the psychological climate in a particular group should be based on knowledge and consideration of the distinctions referable to sociodemographic structure of that group, level of development in it of the main indicators of psychological climate, hierarchy of ratings of these parameters by group members, nature and conditions of group activities. Procedures that may have a positive effect in one case may only worsen the situation in another. Nevertheless, we can outline some general means of improving the psychological climate, which could be modified and specified in accordance with the distinctive features of a given group. Here are the main directions of such work:

1. Systematic improvement of working conditions and organization. It is only by means of utmost improvement of conditions and organization of work in the group that one can expect a complete return from its members, a stable and high psychological climate in groups, because no interpersonal relations, even the best, in a group can compensate for overt flaws in organization of labor and serious deficiencies in working conditions. Vast opportunities for improving the psychological climate at the expense of sociopsychological factors will be available in expressly the departments where working conditions and organization will be raised to the appropriate level.
2. Comprehensive development of the informal structure of the group. The factors that normalize the psychological climate in a group with reference to the parameter of development of its unofficial structure are, for example, spending free time together, active discussion of various issues in the group, etc. It must be borne in mind that, as a rule, there is more frequent discussion about how to work better than how to better spend time off in groups where the psychological climate is good, i.e., development of the informal structure of the worker group should proceed primarily through development of the system of work relations. For it is expressly joint work that is the basis of appearance of emotional relations in a group, and the nature of relations formed in the group, the content of its solidarity, will depend largely on the extent to which the goals of the group become the personal goals of each of its members.
3. Improvement of management of worker groups is one of the main factors of increasing the effectiveness of group performance in general and development of its psychological climate in particular. Of course, replacement of ineffective administrators could be used as an extreme measure to normalize processes of supervision and management of the group. At the same time, it is desirable to use other means as well, in particular, training supervisors, primarily those of primary groups, in the fundamentals of sociopsychology, scientific methods of decision making, etc.
4. Increasing social activities [public service?] of worker group members.
5. Involving rank and file enterprise workers in solving problems of management of worker groups. It is imperative to make public the management decisions that have been made, as well as to listen closer to the opinion of members of worker groups. It is only by making the group an active participant of decision making and management of work that one can eradicate completely the conceptions that prevail among some of the workers to the effect that all their comments and suggestions are useless. One must make every effort to fight against such attitudes, primarily through active steps.
6. Implementation of the principle of making information available to all and disseminating it with regard to work and the social life of the organization as a whole and its different departments. A worker who is informed about the achievements and prospects for his group feels that it belongs to him, is strongly attached to it and is unlikely to want to change jobs without any serious grounds.

Specially organized and properly conducted sociopsychological studies occupy a special place in the system of measures used to improve the psychological climate in worker groups. Discussion of the results of such studies within the group, with representatives of management and social [public] organizations has a

beneficial effect on the situation in the group. The results of such studies can also be used on all levels of management of worker groups for the purpose of improving the effectiveness of their work.

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